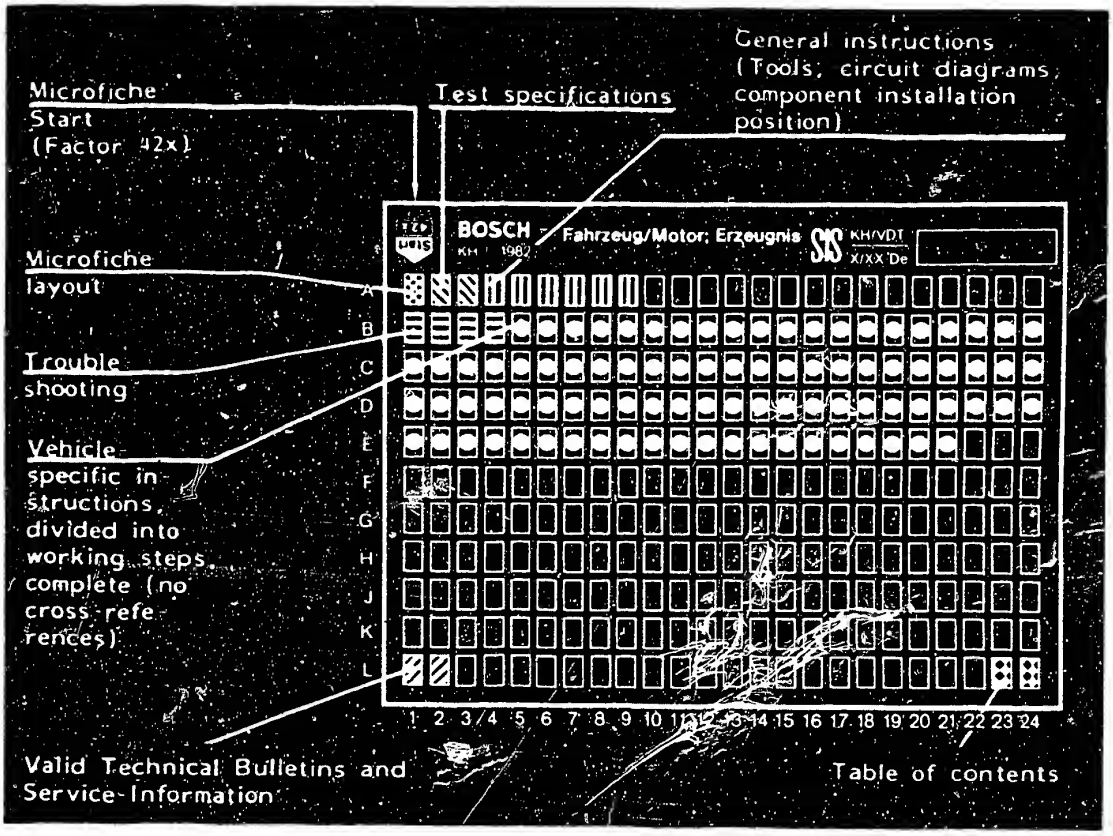
Structure of microfiche



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E16	Product/assembly/test step Vehicle/engine	

Coordinate

3. Limits of section

Beginning	Mid-section	End	One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

C6

1. Test specifications

C9

1.1 Idle speed

750 ± 25 min^{-1}

C10

1.2 Nozzle-opening pressure

130 + 8 bar

C15

1.3 Filter test

Max. permissible pressure difference = 0.3 bar

D1

1.4 Compression loss

Max. permissible 25%

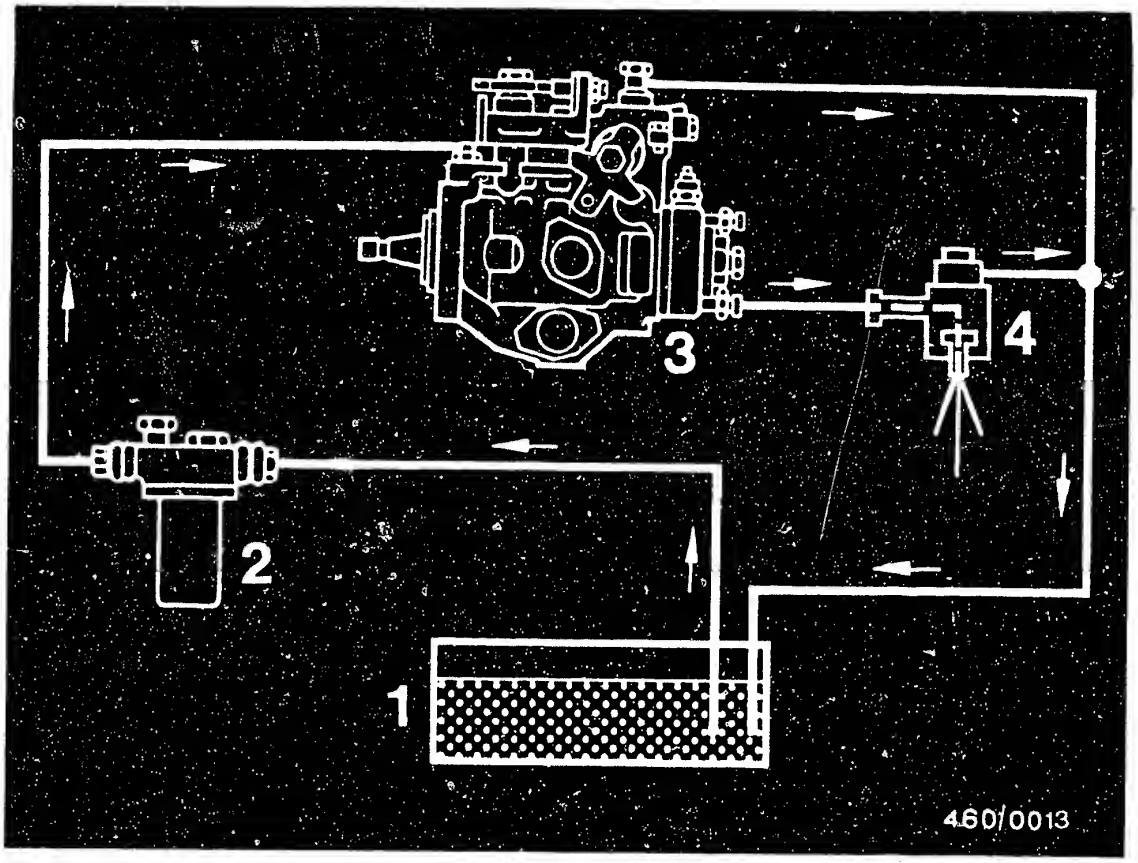
E17

1.5 Injection timing

Engine position = TDC on cylinder 1
Pump position = 0.82 mm ABDC

1.6 Tightening torques

	Nm	kgfm
Fuel-injection pump fastening screws	29	2.9
Fuel-injection pump gear	49	4.9
Camshaft gear	118	11.8
Pulley	137	13.7
Belt tensioner	56	5.6
Nozzle-holder assembly fastening screws	39	3.9
Fuel lines	25	2.5
Sheathed-element glow plugs	15	1.5

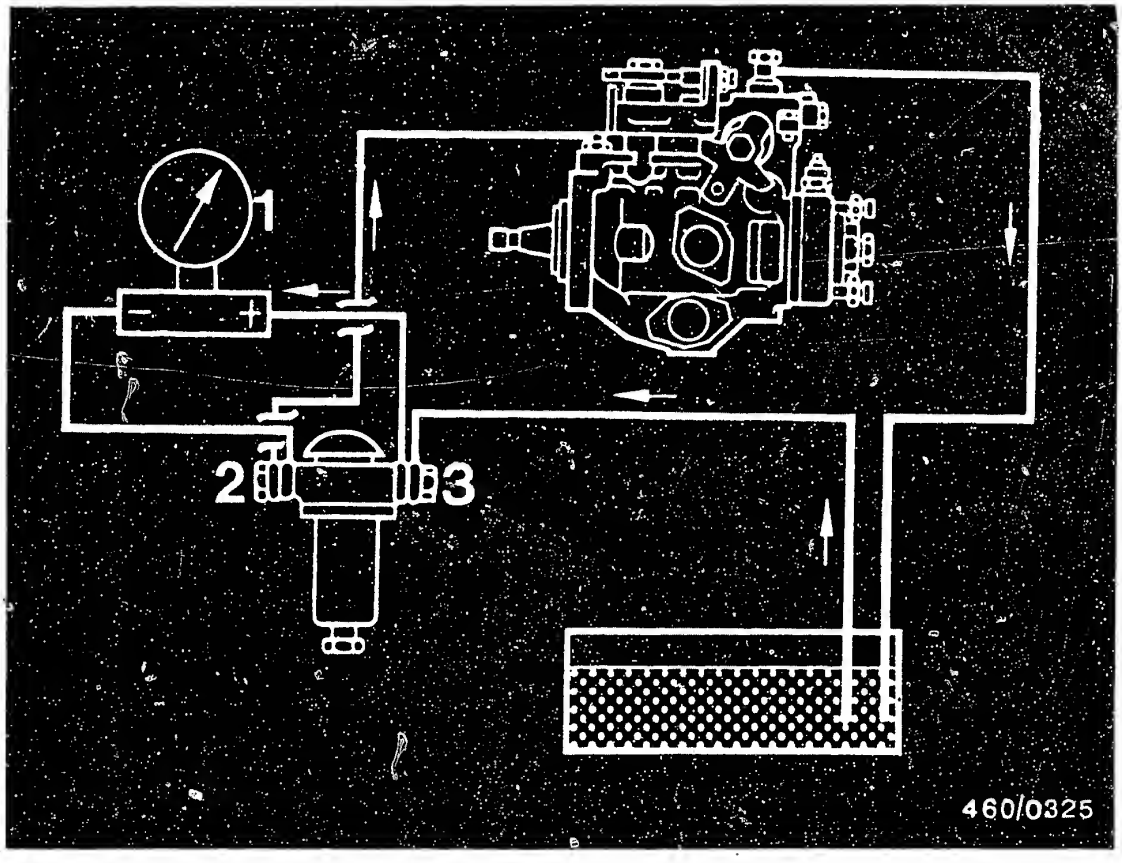


1 = Fuel tank
2 = Fuel filter
3 = Distributor-type fuel-injection pump
4 = Injection nozzles

2. Connection diagrams of fuel lines

2.1 Diagram of fuel lines

The fuel lines are connected as shown in the above diagram.
The fuel flows in the direction of the arrows.



1 = Differential-pressure gauge
2 = Filter outlet (use inlet union and extra-long inlet-union screw 2 443 456 020)
3 = Filter inlet (use inlet union and extra-long inlet-union screw 2 443 456 020)

2.2 Connection diagram for filter test

Connect differential-pressure gauge to fuel filter using appropriate connecting pieces.

3. Test equipment and tools

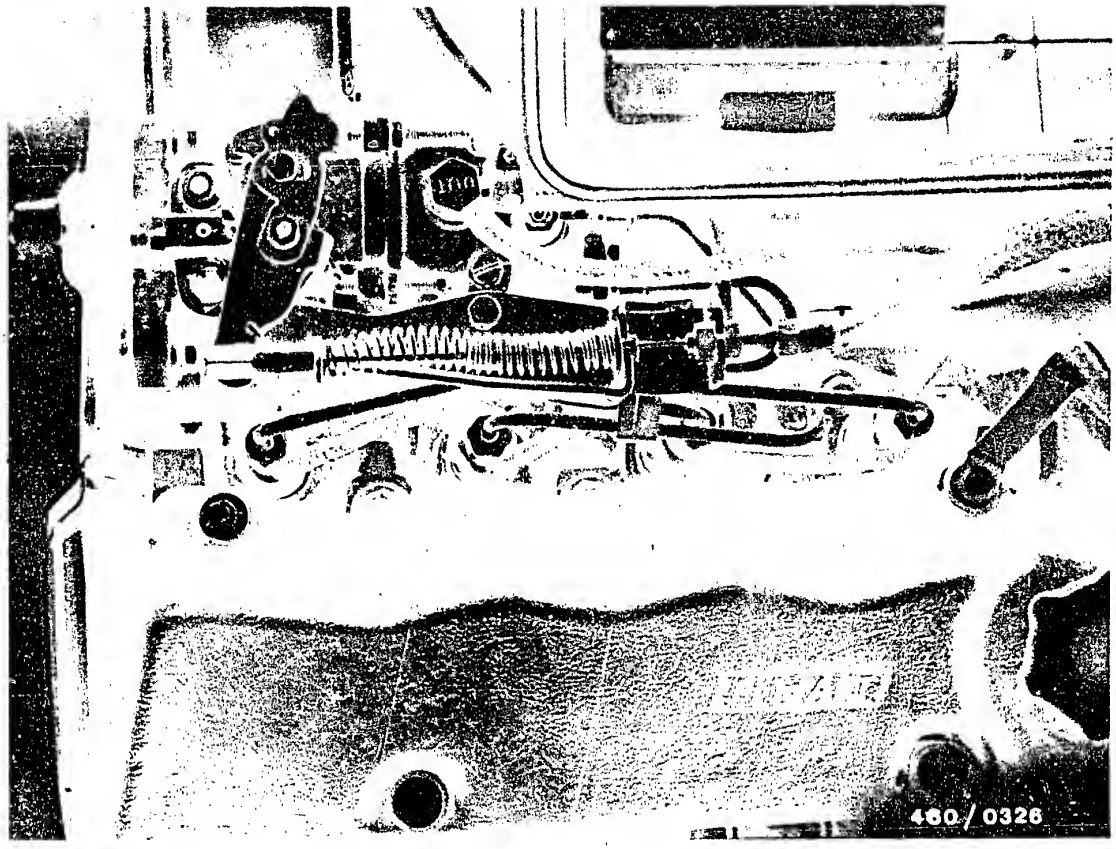
Designation	Part No.	Use
Puller *	Fiat tool A. 42129	Removing injection pump gear
Offset socket wrench *	Fiat tool A. 50176	Removing fuel-injection pump
Box wrench	KDEP 1115	Loosening the fuel-injection tubing
Measuring tool	KDEP 1085	Injection timing
Dial indicator 1/100 mm divisions	1 687 233 012 or 1 687 233 011 with adapter KDEP 1042	Injection timing
Nozzle tester	EFEP 60 H 0 681 200 502	Testing the injection nozzles
Compression tester	commercially available	Testing the engine compression
Compression-loss tester	EFAW 210 A 0 681 001 901	Testing the engine compression loss
Tachometer	commercially available	Setting the engine speed

* Buy tool from local Fiat agent.

Test equipment and tools

Designation	Part No.	Use
Differential-pressure gauge	commercially available e.g. Henni Co. NG160/311-911/ -1.0+4.0 bar Fa. Henni Nauheimerstr. 78-80 7000 Stuttgart 50	Filter test
Smoke tester	0 681 169 039 0 681 169 038	Smoke test
Holding device * Part-piece *	Fiat tool A 60473 A 60473/10	Locking the injection pump gear

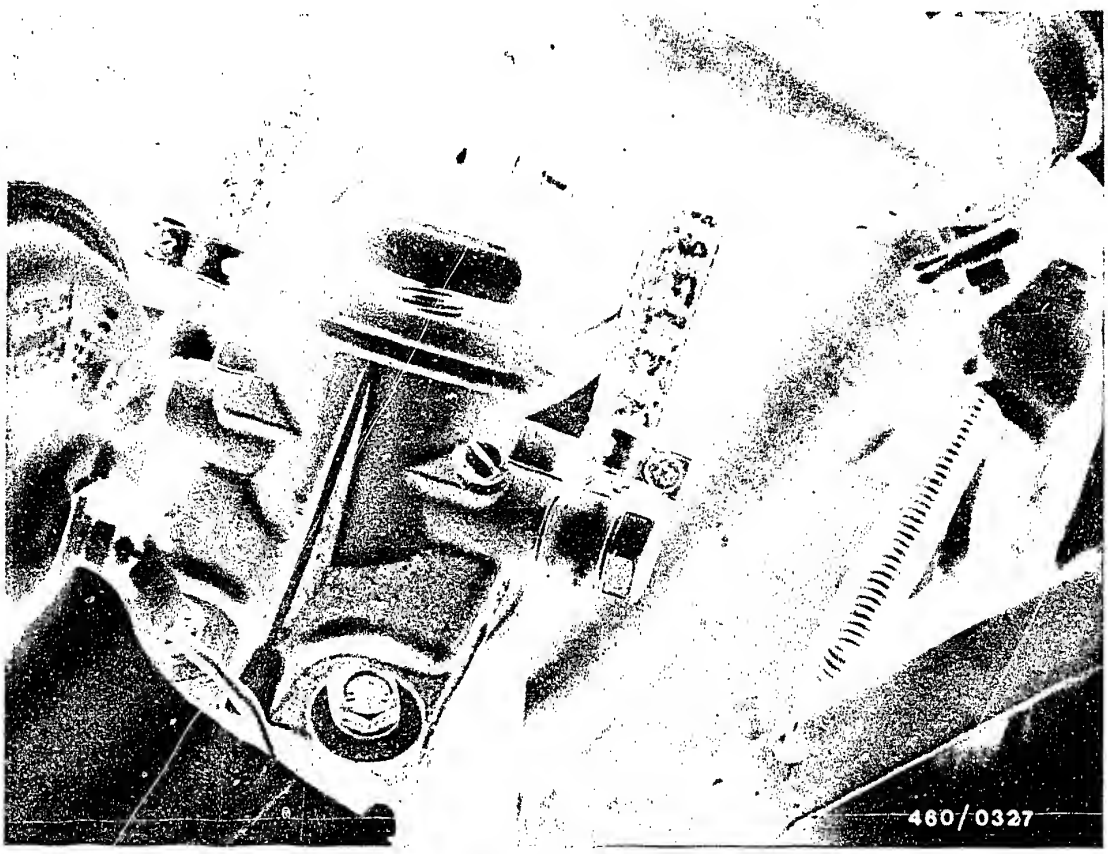
* Buy tool from local Fiat agent.



4. Installation position of components

4.1 Installation position of injection nozzles and fuel-injection pump:

On the engine block on the right-hand side in the forward direction of travel.



4.2 Installation position of fuel filter

Next to the fan wheel on the left-hand side in the forward direction of travel.

5. Trouble-shooting

Customer complaint (symptom)

1. Engine fails to start or starts only with great difficulty when warm.
2. Engine fails to start or starts only with great difficulty when cold.
3. Engine hunts when idling.
4. Erractic idling when engine is warm.
5. Engine misses during vehicle operation.
6. Unsatisfactory performance.

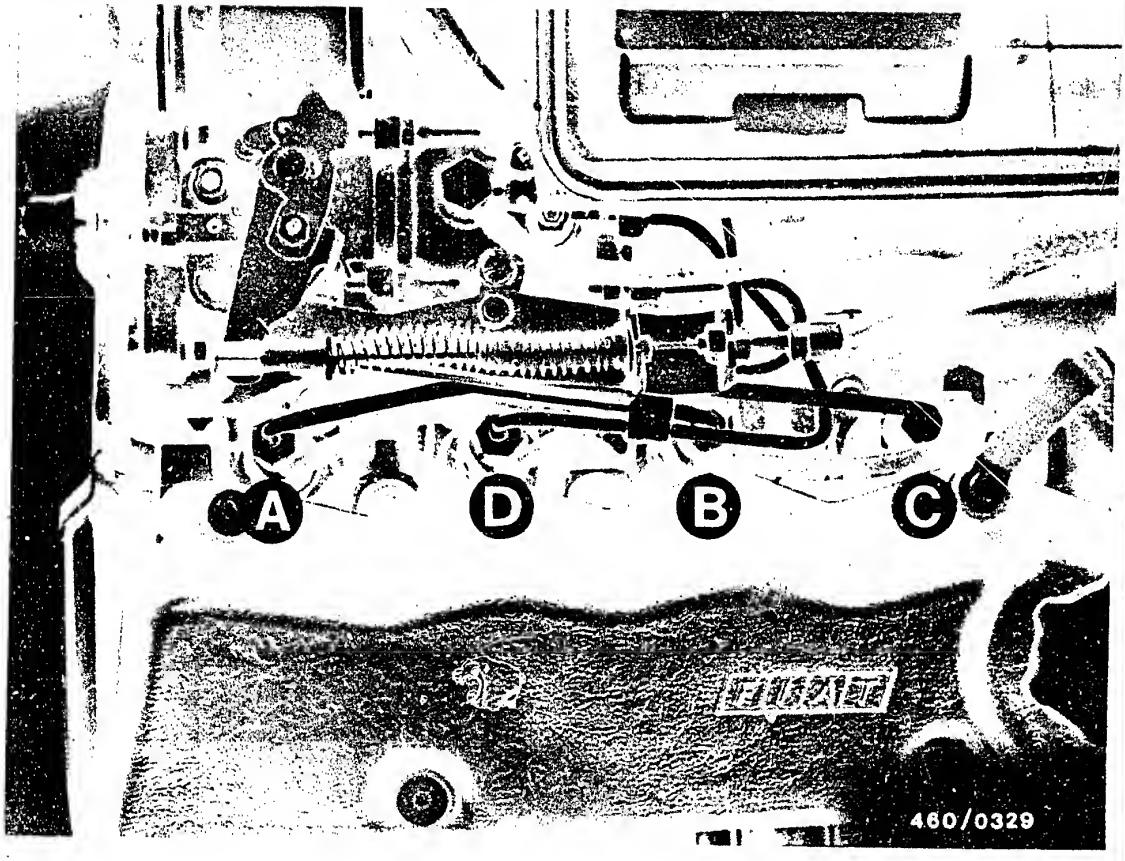
1	2	3	4	5	6	Cause	Coordinate
●	●			●	●	Tank empty; tank vent clogged	B 5
	●		●			Injection sequence does not correspond to firing sequence	B 6
				●		Overflow restriction clogged	B 7
●	●					Shutoff device defective	B 8
		●		●	●	Inlet-union screws of inlet and return lines clogged	B 12
●	●		●	●	●	Air in fuel system	B 13
	●					Heavy paraffin deposits in filter	B 15
●	●			●	●	Connections loose; lines leaky or broken	B 18
●	●			●	●	Supply lines clogged	B 20
●	●			●	●	Fuel-injection tubing clogged or constricted	B 20
					●	Engine air filter clogged	C 1
			●			Idle speed incorrect	C 9
●	●		●		●	Injection nozzle defective	C 10
	●		●		●	Start of pump delivery incorrect	E 17
●	●			●	●	Fuel filter clogged	C 15
	●					Pre-heating system defective	C 18
					●	Timing device defective	C 21
	●		●			Engine compression poor or uneven	D 1
					●	Maximum speed incorrectly adjusted	D 12
●	●	●	●	●	●	Fuel-injection pump (governor) defective or out of adjustment	D 12

7. Excessive fuel consumption.	8. Engine cannot be switched off.	9. Engine runs rough, black smoke in full-load range; possibly lack of power.	10. Fog-like smoke in full-load range (white)	11. Incorrect engine speed.	12. Engine will not rev up when cold.	13. Distributor-type fuel-injection pump becomes too hot.	Cause	Coordinate
			●		●		Tank empty; tank vent clogged	B 5
		●		●	●		Injection sequence does not correspond to firing sequence	B 6
						●	Overflow restriction clogged	B 7
	●						Shutoff device defective	B 8
			●	●	●		Inlet-union screws of inlet and return lines clogged	B 12
			●		●		Air in fuel system	B 13
					●		Heavy paraffin deposits in filter	B 15
●							Connections loose; lines leaky or broken	B 18
			●		●		Supply lines clogged	B 20
			●		●		Fuel-injection tubing clogged or constricted	B 20
		●					Engine air filter clogged	C 1
				●			Idle speed incorrect	C 9
		●					Injection nozzle defective	C 10
●		●	●		●		Start of pump delivery incorrect	E 17
			●		●		Fuel filter clogged	C 15
							Pre-heating system defective	C 18
		●	●				Timing device defective	C 21
●					●		Engine compression poor or uneven	D 1
				●			Maximum speed incorrectly adjusted	D 12
●	●	●	●	●	●	●	Fuel-injection pump (governor) defective or out of adjustment	D 12

6. Check tank vent

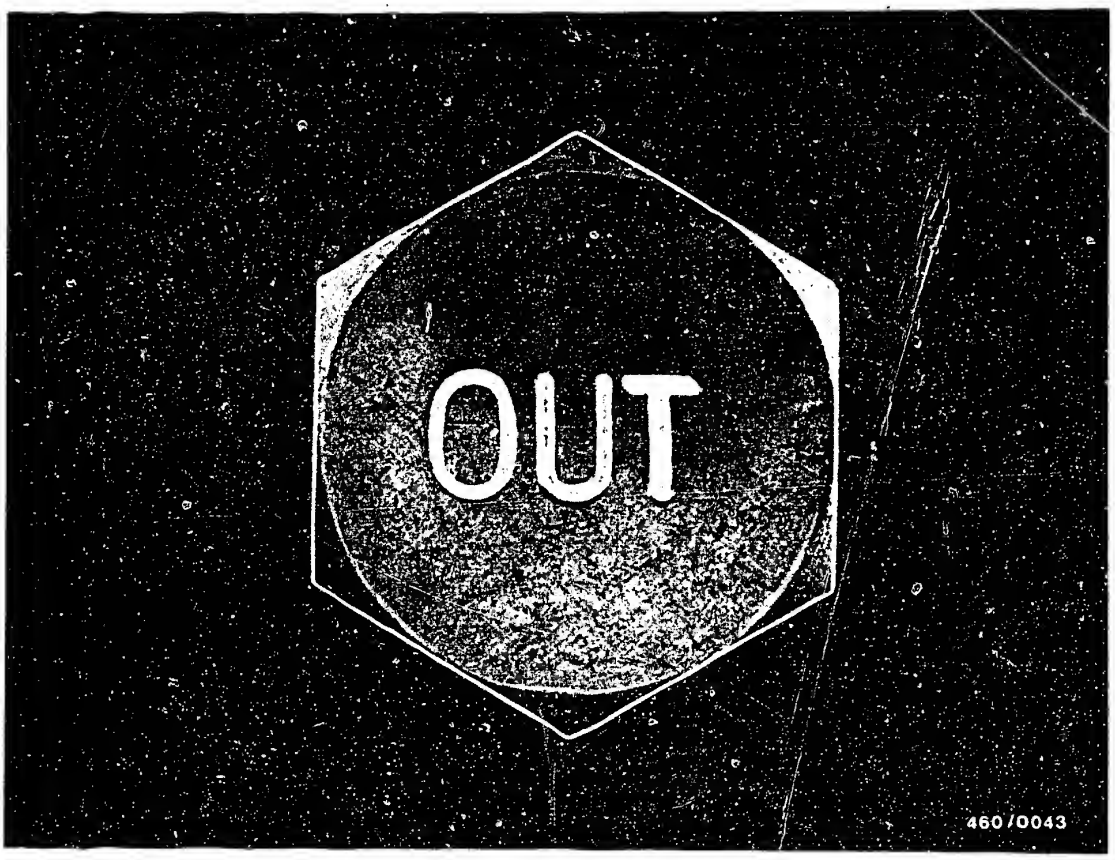
Open filler cap.
If the fault disappears after opening the filler cap, the tank vent is defective.

Check the tank vent for clogging.



7. Check routing of fuel-injection tubing

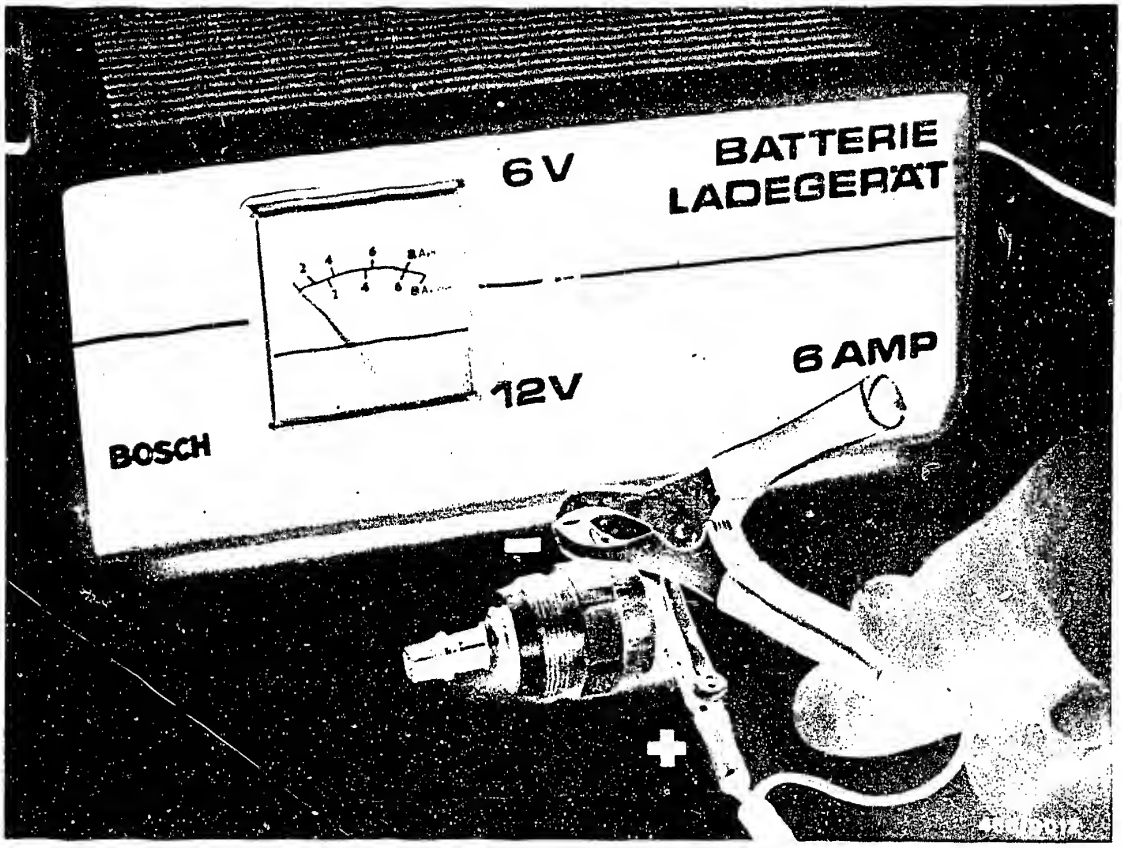
The individual fuel-injection lines are held together by clamps so that it is impossible for the outlets to be mixed up. If, however, there is any doubt, check the routing of the lines as shown in the picture above. The pairing of the fuel-injection pump outlets with the individual engine cylinders is identified by the letters A - D.



9. Check overflow restriction

Unscrew overflow restriction on fuel-injection pump (marked "out").

Perform visual inspection of wire screen for impurities. If in doubt, replace overflow restriction.



9. Check operation of shutoff device

9.1 Engine fails to start

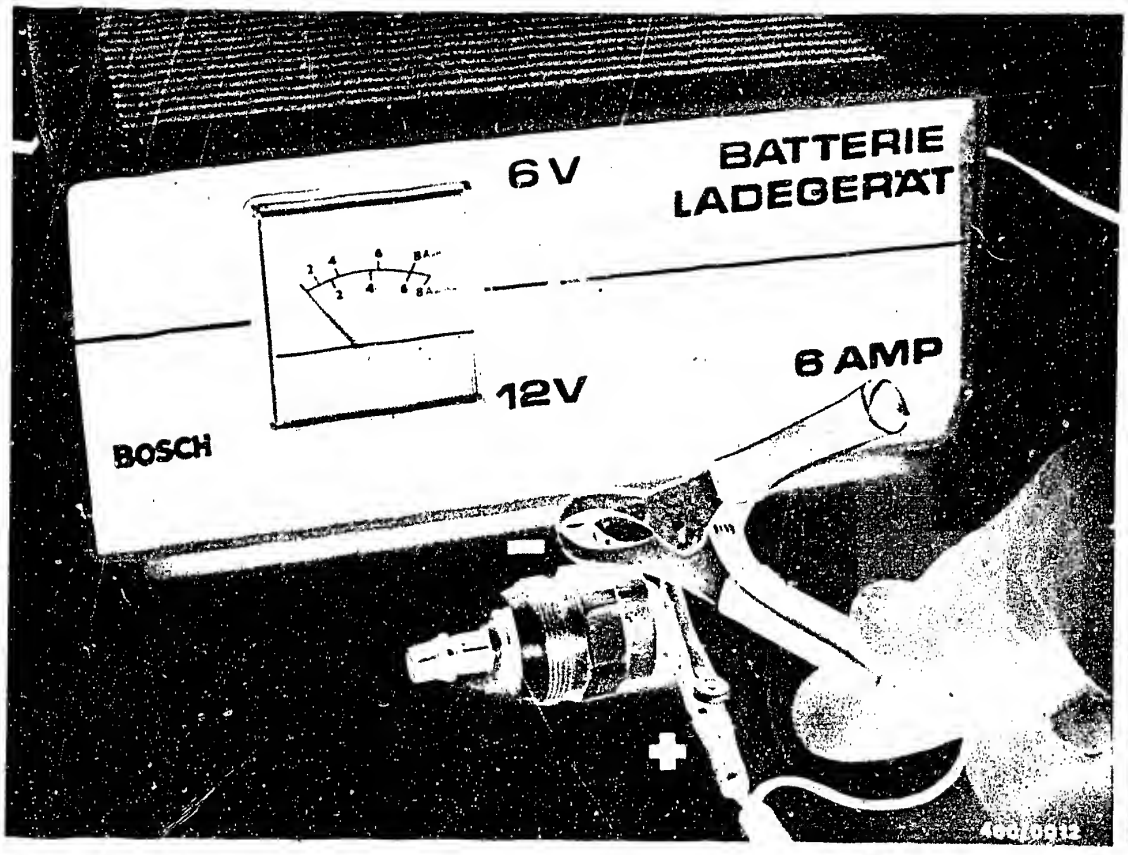
Check whether solenoid-operated valve is supplied with voltage (min. 10 V) with glow-plug and starter switch switched on (drive position).
If voltage is present, remove fuel-injection tubing and take out solenoid-operated valve.
Cleanliness is essential.

When removed, check operation of solenoid-operated valve.

Note:
When removed, the solenoid-operated valve must only be supplied with voltage for a short period of time since it is no longer being cooled by the fuel.

9.2 Engine cannot be switched off

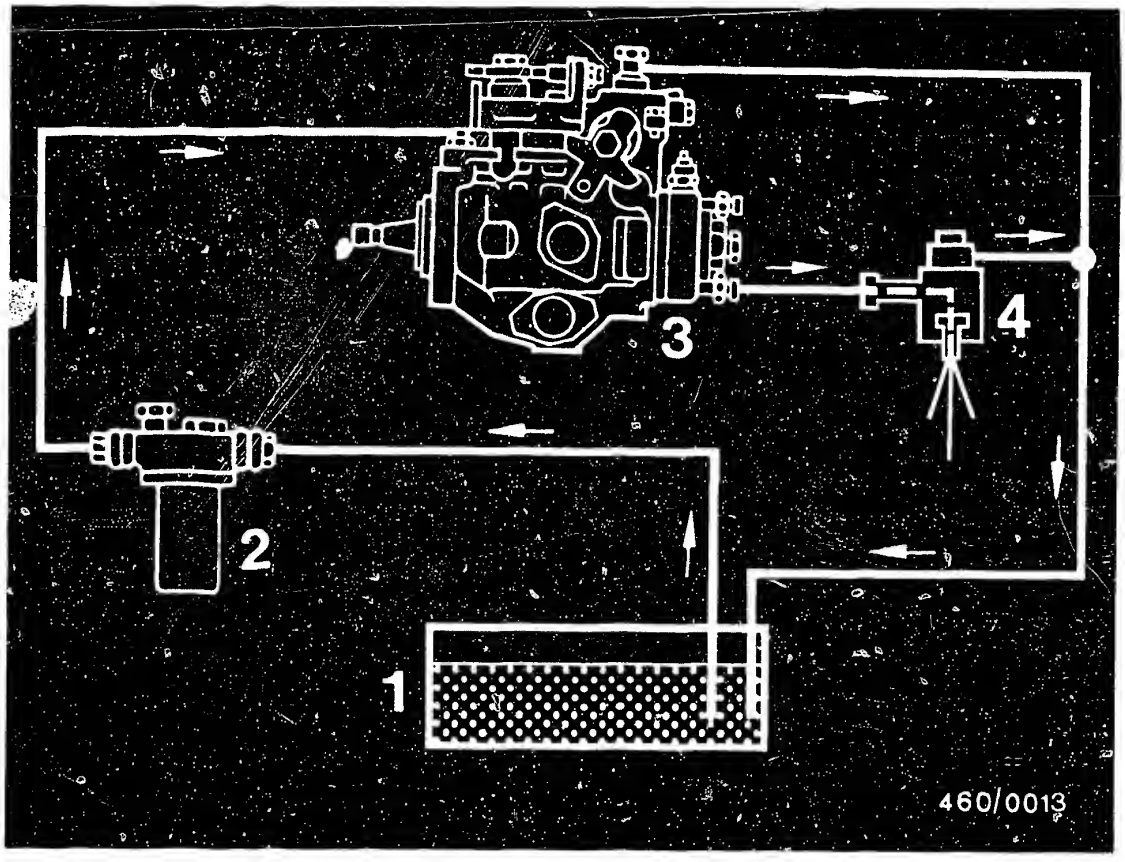
With the glow-plug and starter switch in the stop position there must be no voltage across the solenoid-operated valve, i.e. the fuel inlet to the distributor-pump plunger is interrupted.
If the engine runs on, although there is no voltage across the solenoid-operated valve, the engine can be switched off as follows:
select 3rd or 4th gear. Jam on footbrake and let out the clutch.



9.2.1. Solenoid-operated valve test

Remove fuel-injection tubing.
Take out solenoid-operated valve.
Cleanliness is essential.
When removed, check operation of solenoid-operated valve.

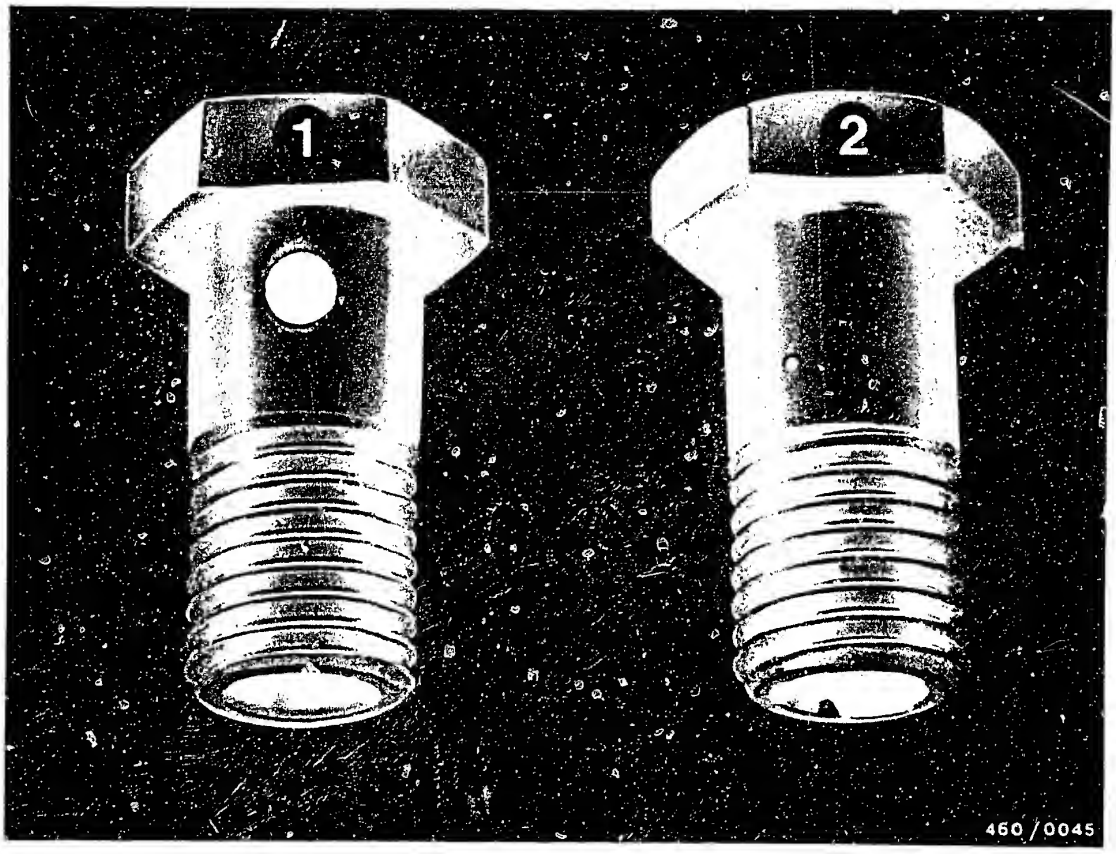
Note:
When removed, the solenoid-operated valve must only be supplied with voltage for a short period of time since it is no longer being cooled by the fuel.
Check valve seat in hydraulic head (visual inspection).



1 = Fuel tank
2 = Fuel filter
3 = Distributor-type fuel-injection pump
4 = Injection nozzles

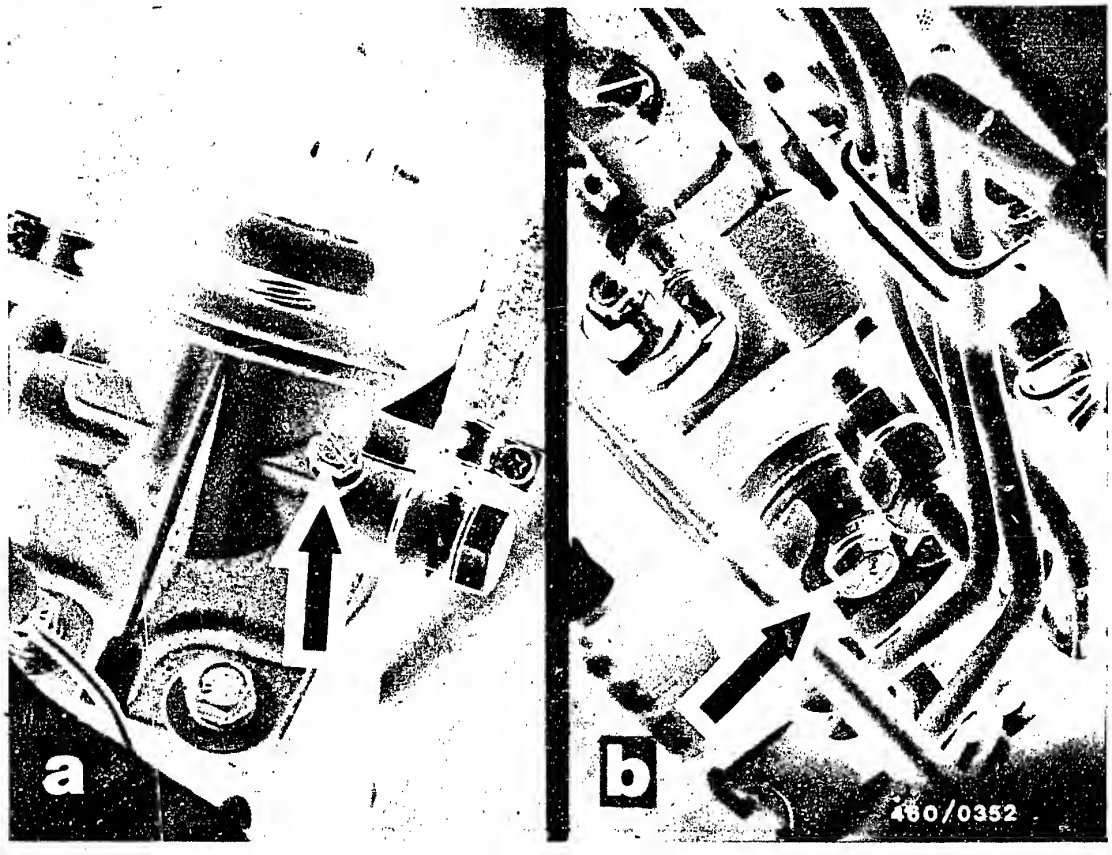
10. Connection diagram of fuel lines

The fuel lines are connected as shown in the above diagram.
The fuel flows in the direction of the arrows.



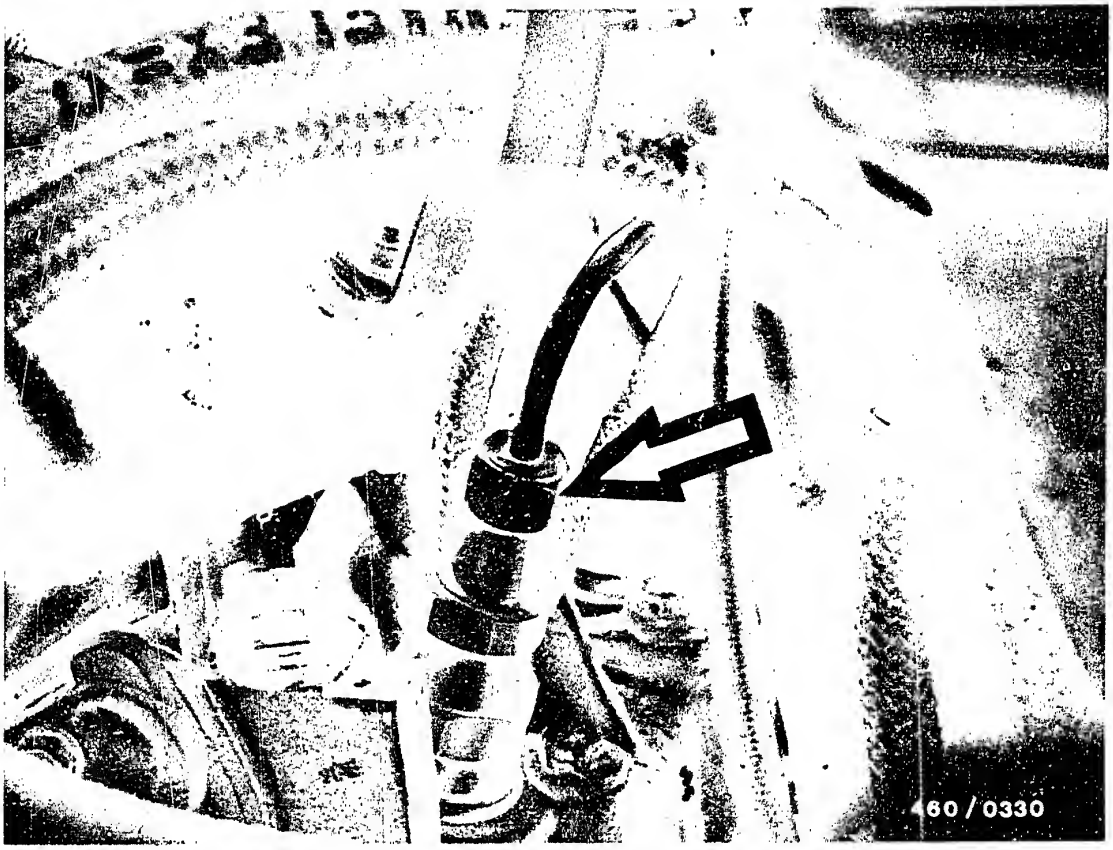
As regards the connections to the fuel-injection pump, ensure that the inlet-union screw for fuel inlet (1) and the throttle screw for fuel return (2) are not mixed up.

The throttle screw is located on the cover of the fuel-injection pump and the head of the screw is marked with the word "out".



11. Bleed fuel system

Fill up fuel filter and fuel-injection pump with diesel fuel.
Loosen bleeder screw on fuel filter (arrow - Fig. a) and on injection pump (arrow - Fig. b) by a few turns.
Operate hand primer on fuel filter until the fuel escaping from the bleeder screw of the fuel filter is free of bubbles.
Tighten fuel filter bleeder screw.

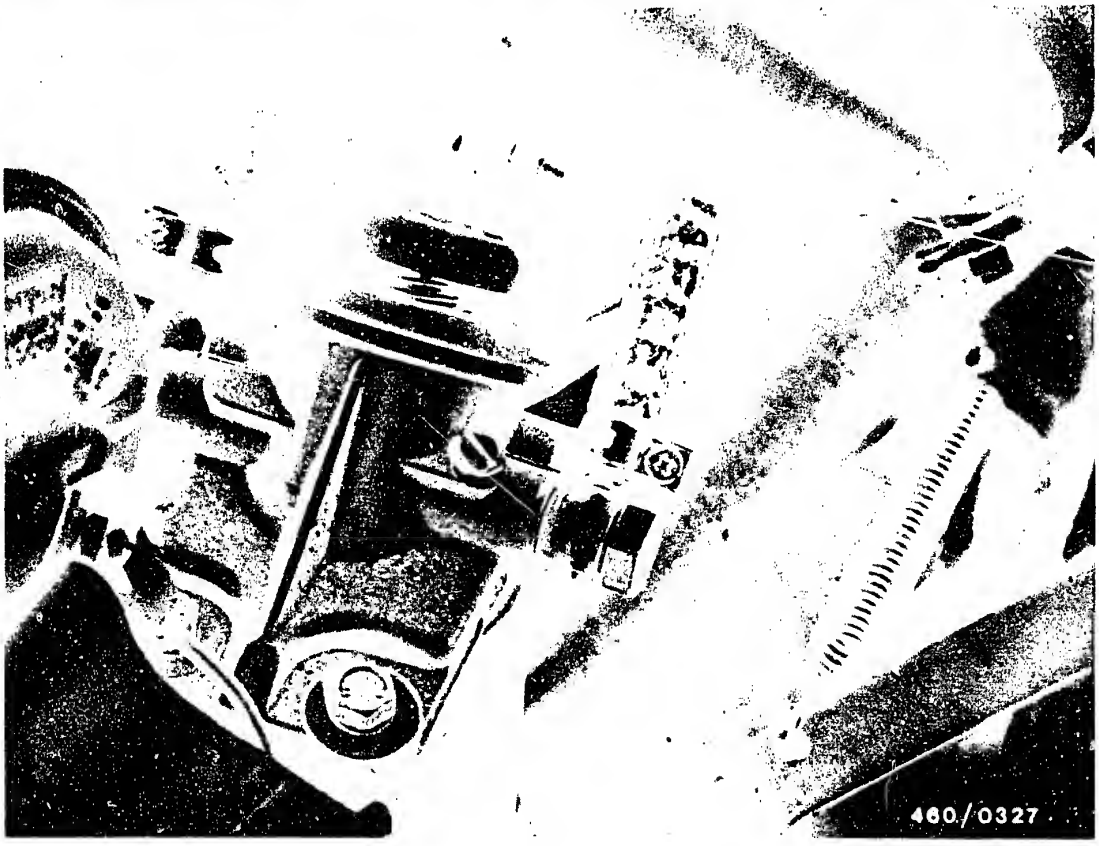


Loosen union nuts (arrow) of fuel-injection tubing on nozzle-holder assemblies.

Actuate starting motor without pre-heating. When the fuel escaping from the bleeder hole in the injection pump is free of bubbles tighten the bleeder screw.

Continue to actuate starting motor until fuel escapes at union nuts of nozzle-holder assemblies.
Tighten union nuts.

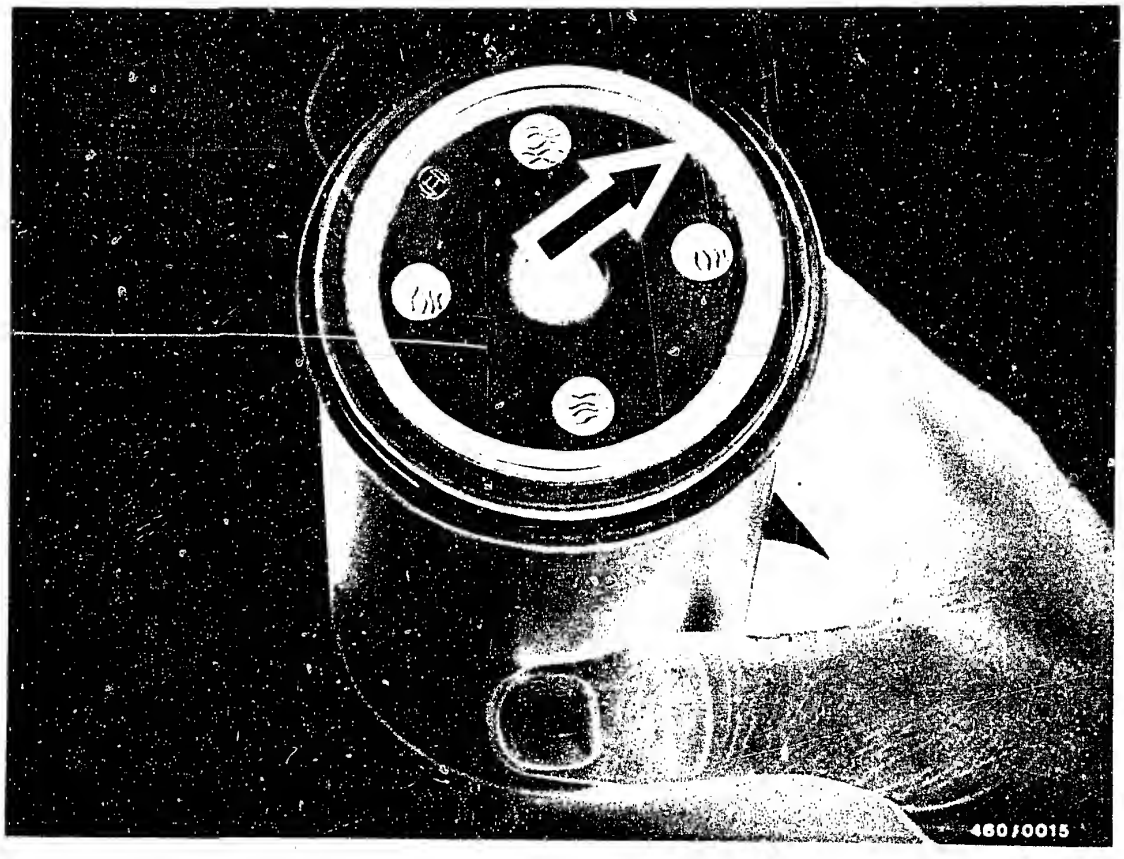
Actuate starting motor until engine starts.



12. Replace and drain filter box

12.1 Replace filter box

Unscrew fuel filter from the filter cover.
If stuck, loosen filter box with special wrench, e.g. Matra W 167. Catch escaping fuel.

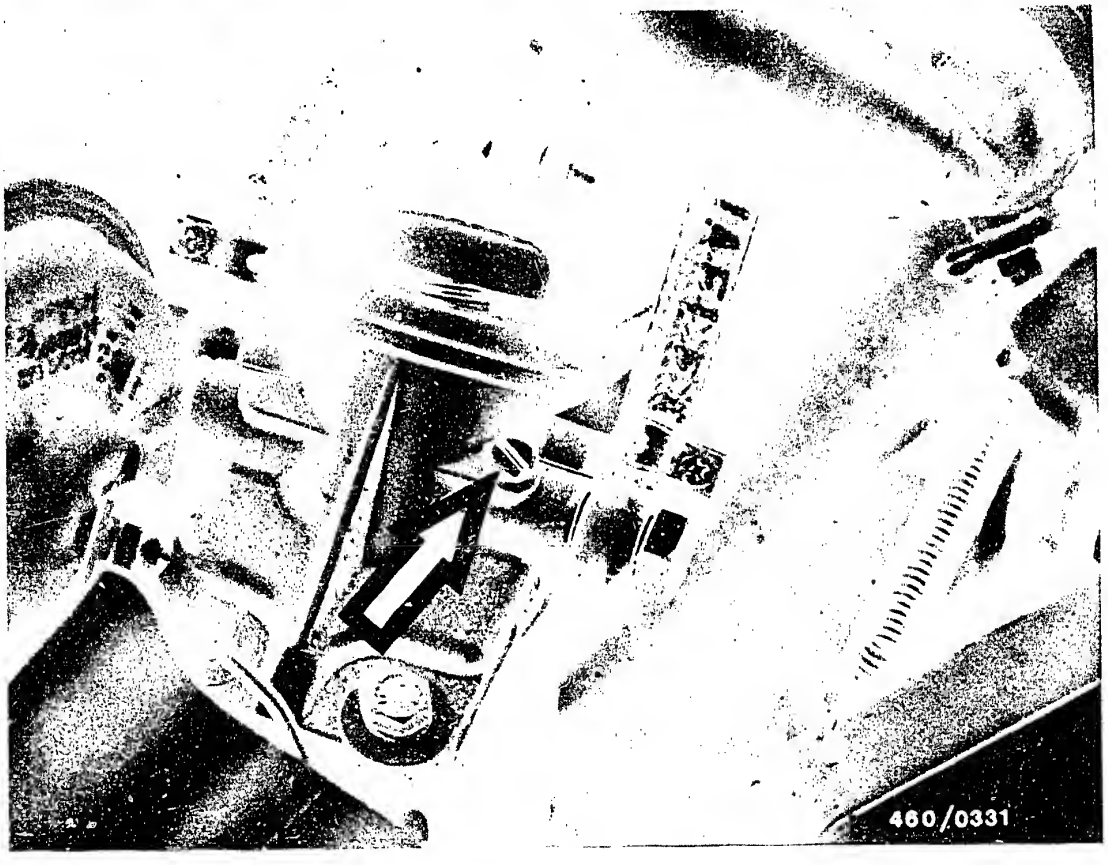


Rub diesel fuel into the rubber seal (arrow) of the new filter box.

Screw the filter box into the cover by hand and tighten.

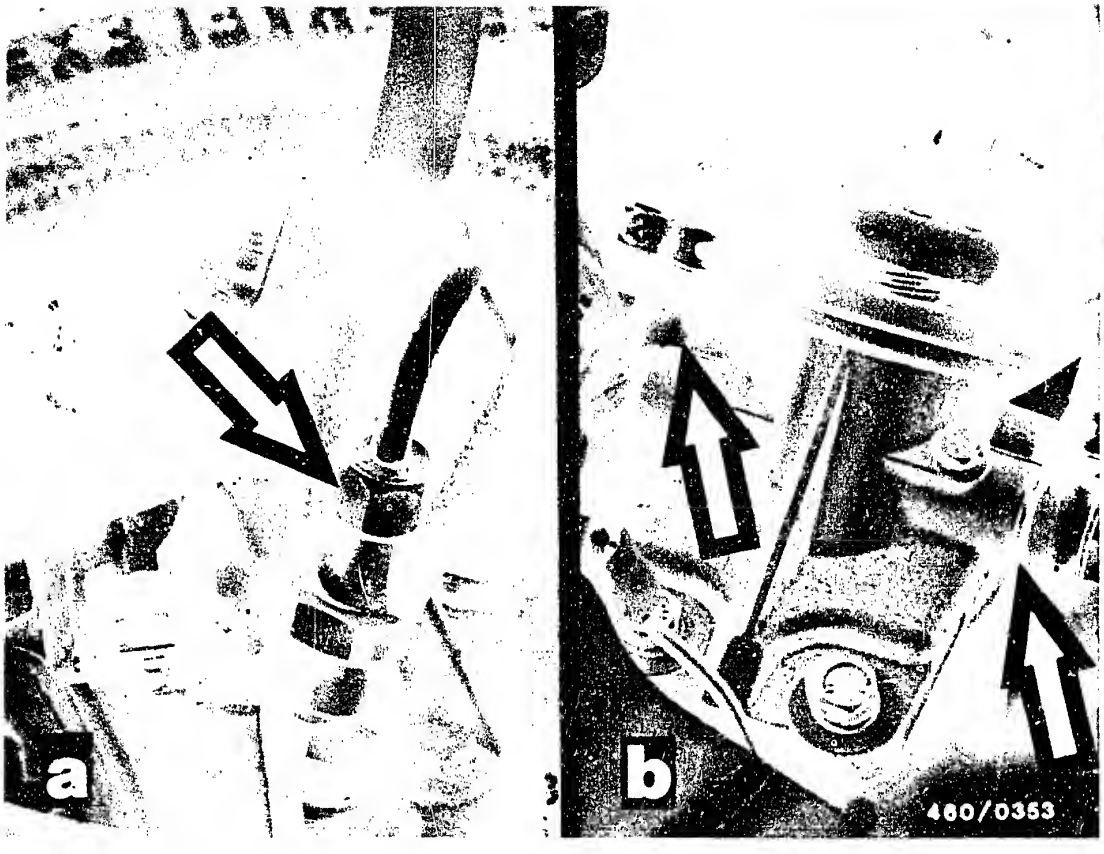
Check the fuel filter for leaks.

In the case of winter fuel it may be necessary to add petroleum as specified by the vehicle manufacturer.



12.2 Drain water from fuel filter

Loosen bleeder screw (arrow) on the filter cover by a few turns.
Loosen water-drain screw on the base of the filter and drain water.
Catch liquid in container.
Tighten water-drain screw and bleeder screw and check for leaks.
If necessary, bleed fuel filter.

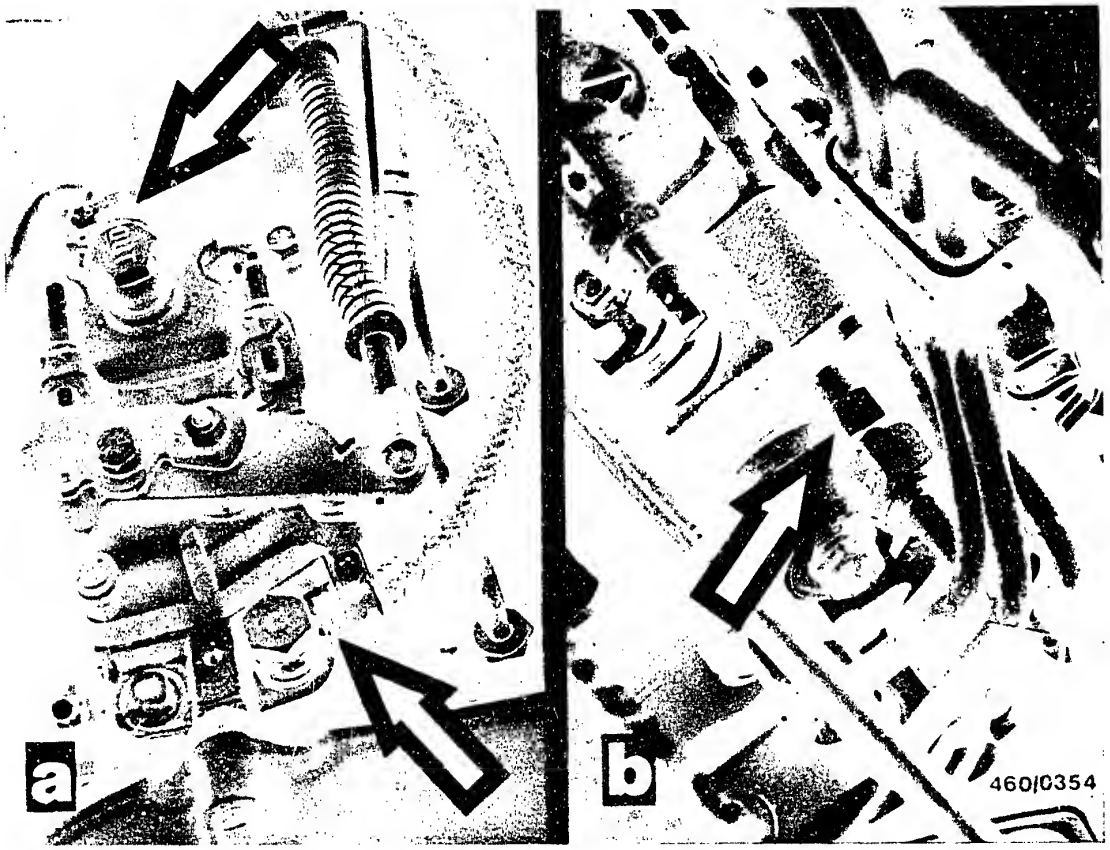


13. Check fuel-injection system for leaks

Perform leak test with engine at normal operating temperature.

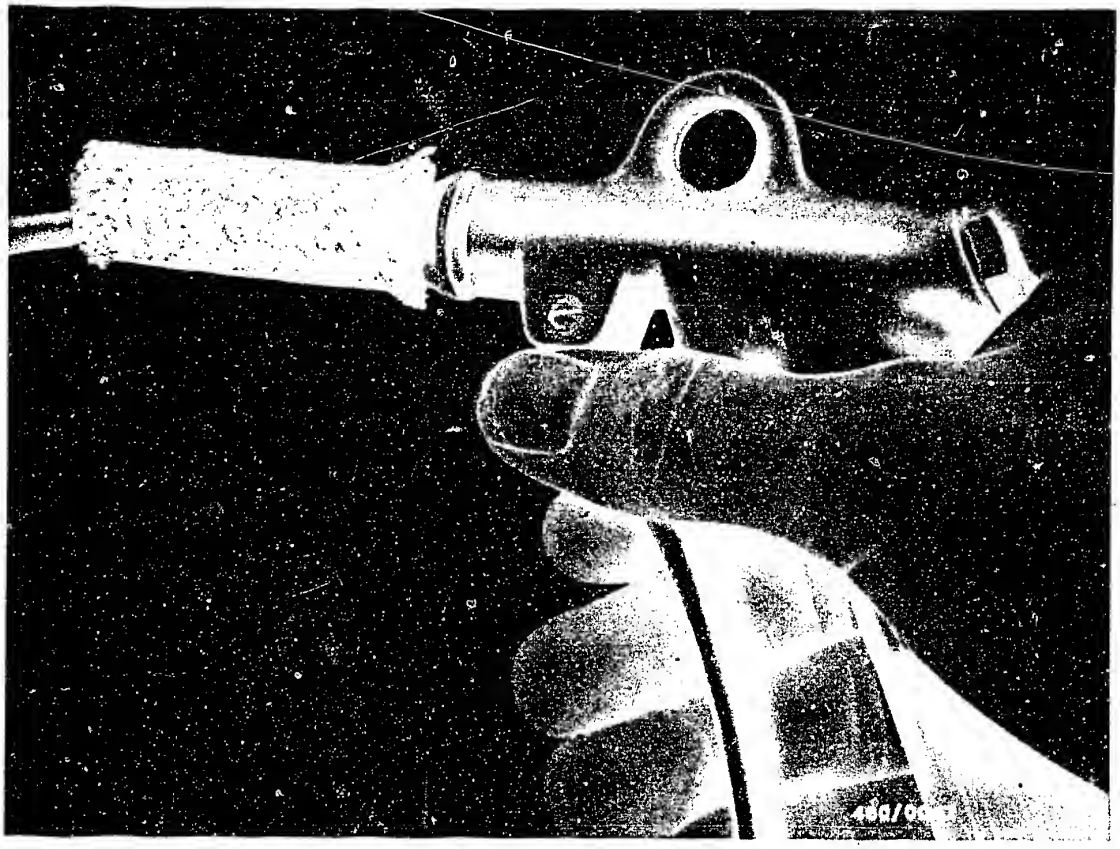
During leak test, check all fuel line connection points. Pay particular attention to:

- Connections on nozzle-holder assemblies (Fig. a)
- Connections on fuel filter (Fig. b)



- Inlet and return lines on distributor-type fuel-injection pump (Fig. a).
- Delivery-valve holders on hydraulic head (Fig. b).

Perform visual inspection of fuel lines for hairline cracks.



14. Check fuel lines

Subject suspect fuel lines to a visual inspection.

If there is no detectable pinching or kinking, the fuel line in question must be removed.

Check fuel line for throughflow using compressed air and clean if necessary.

A suitable hose piece may be used as a side seal for blowing out the fuel lines.

15. Smoke test - check air filter

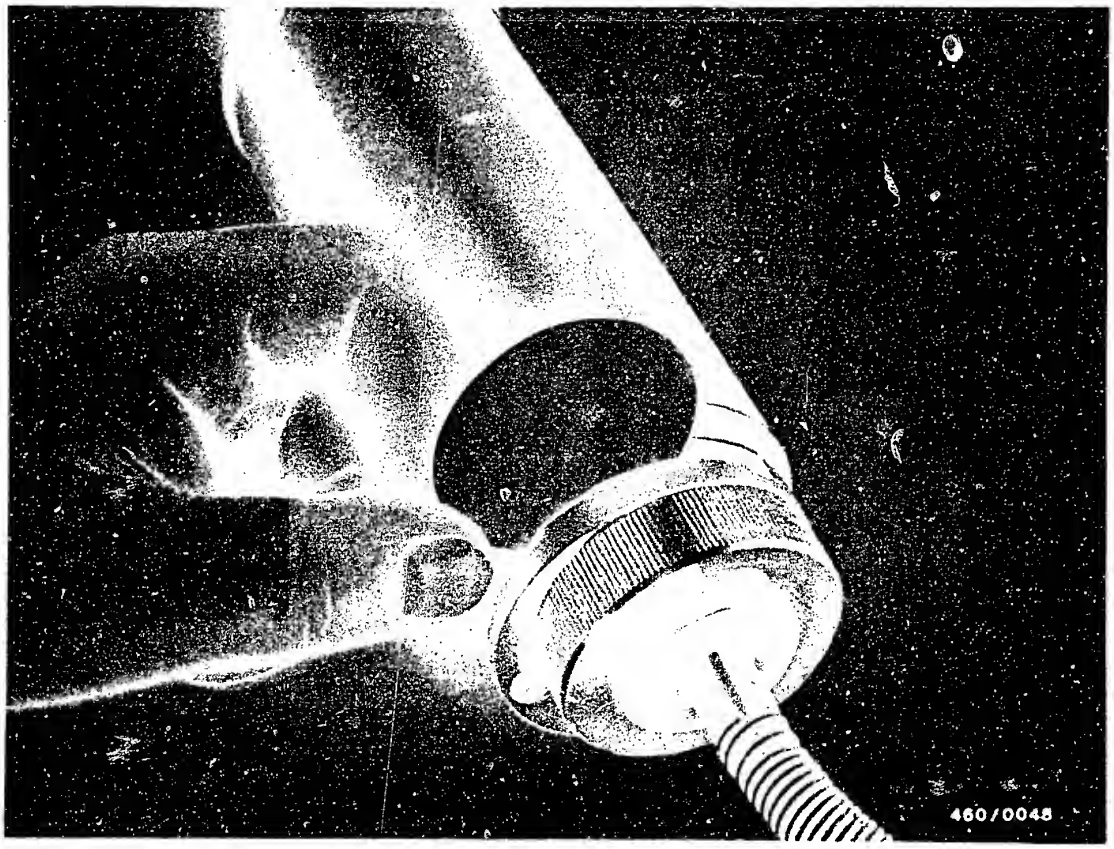
15.1 Smoke test

Summary of the contents of the legal regulations (as at April 1978). Applicable to Federal Republic of Germany.

This regulation applies only to the homologation of motor vehicles having at least 4 wheels with a maximum permissible speed of more than 25 km/h. A smoke emission test is not prescribed for official general inspections.

Parts which may have an influence on environmental pollution must be designed in such a way that the legal requirements are met during operation and despite vehicle vibration.

This applies in particular to cold-start devices and full-load stops. The Rheinland-Westfälische TÜV (Technical Inspection Bureau of Rhineland-Westfalia) in Essen is the sole approval agency.

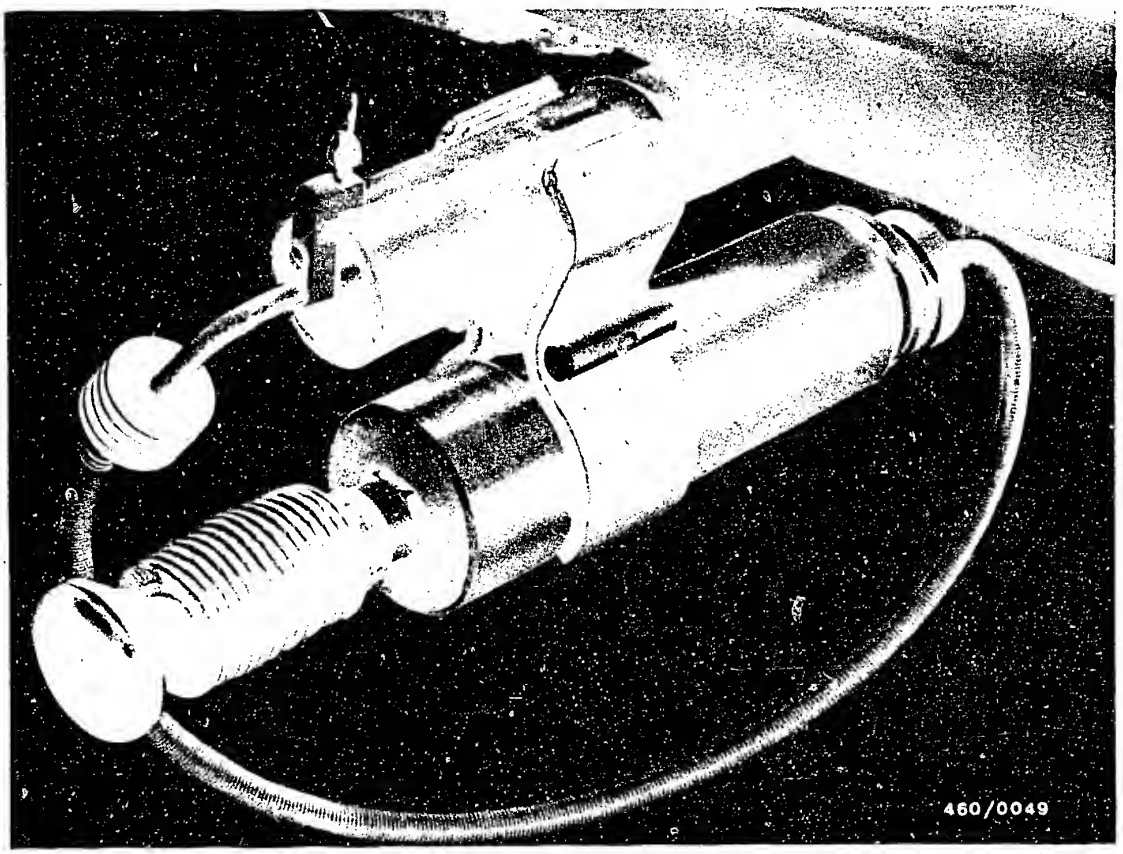


15.1.1 Test setup

The smoke test is conducted using the Bosch filter-type smokemeter.
The filter-type smokemeter consists of the following units:

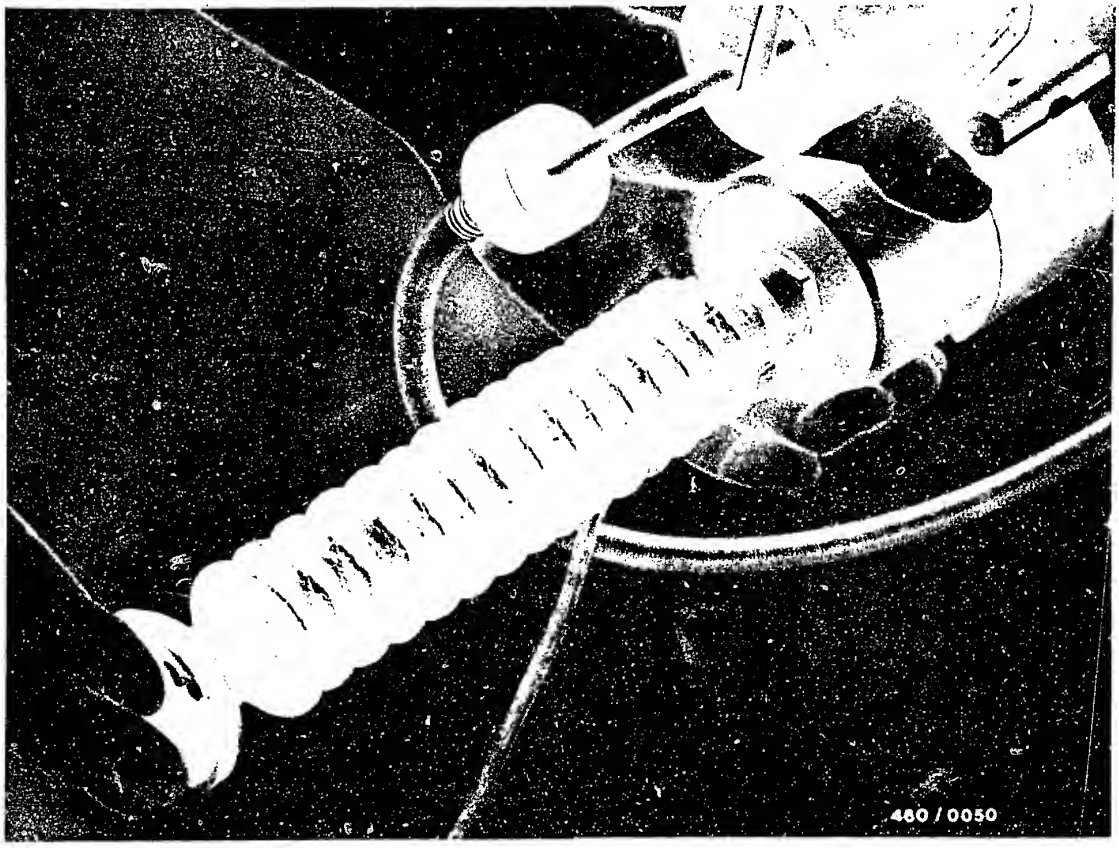
Accessories box with proportioning pump	0 681 169 038
Evaluating unit	0 681 169 039

Insert filter plate into proportioning pump.



Mount sampling pump on exhaust pipe using appropriate clamp.

Introduce exhaust-sample pickup as far as possible into exhaust pipe and clamp in position.

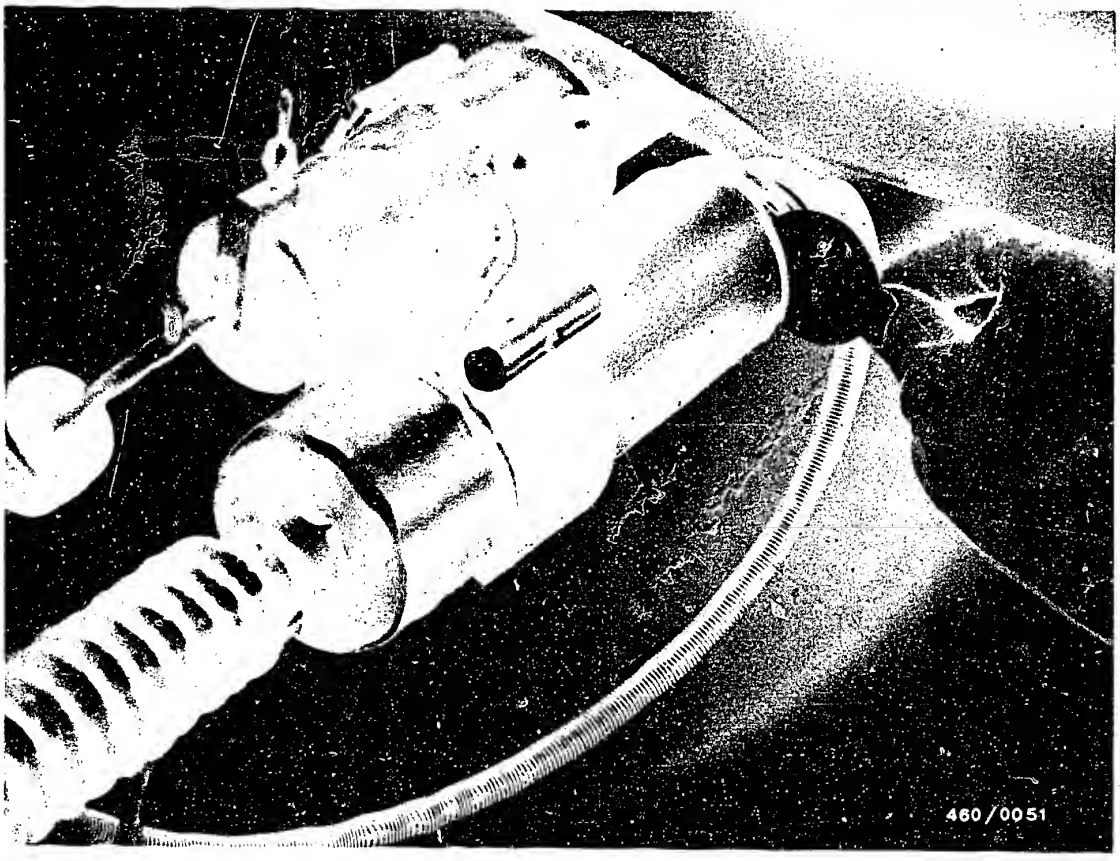


15.1.2 Test procedure

Set proportioning pump by pressing in the black push-button.
Take rubber ball on triggering hose and enter passenger compartment.

The test can be performed on the chassis dynamometer or on the road (gradient).

The chassis dynamometer is preferable in any case.
Find the gear in which, with the accelerator pedal in the full-load position, a speed of approx. 40 km/h is reached. Load the engine so that, with the accelerator in the same position, a speed of approx. 25 km/h is reached.

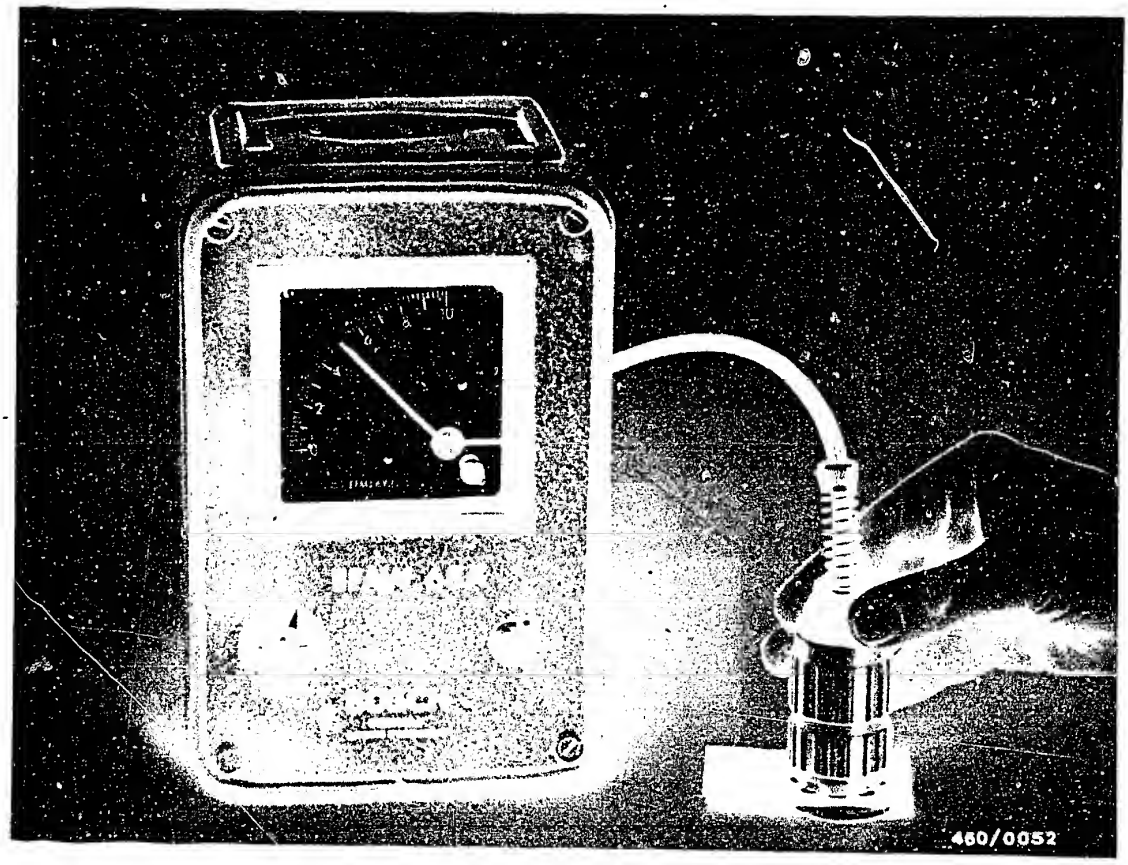


Maintain this load condition for 5 seconds and then trigger the sampling pump by pressing the rubber ball.

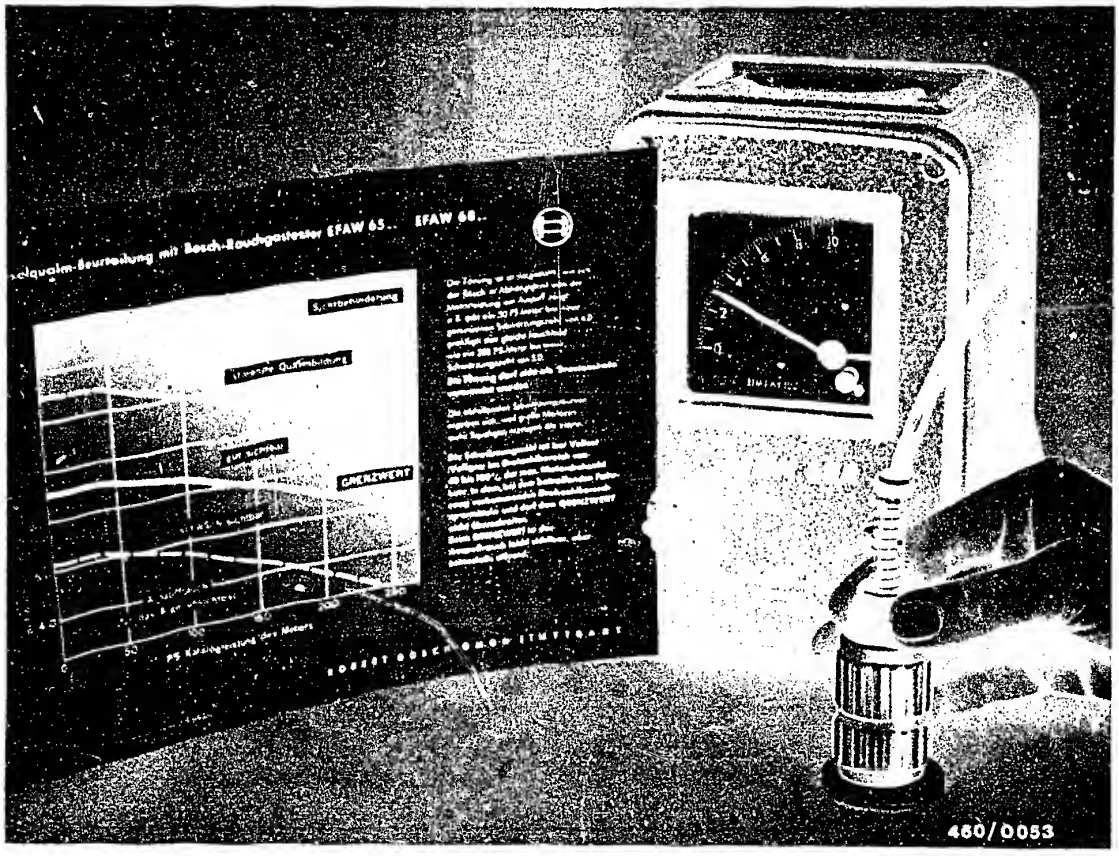
Switch off engine.

Caution!
During the following operation, pay attention to the fact that the exhaust pipe has been heated due to the running of the engine.

Remove filter plate from sampling pump.



Place calibrating plate on approx. 10 clean filter plates. Place photocell of evaluating unit on calibrating plate. Switch on unit and set to 5.0 opacity. Remove calibrating plate and place photocell on clean filter plates. The unit must indicate 0.0 opacity. If necessary, change batteries.
With unit switched off, pointer must indicate 10.0 opacity. Deviations indicate that the unit is defective.
Place filter plate from sampling pump onto the clean filter plates with the sooted side at the top.
Place photocell on this filter plate and read off the smoke factor on the evaluating unit.



Compare smoke factor with evaluation sheet.

Note kW (HP-DIN) data of vehicle manufacturer.

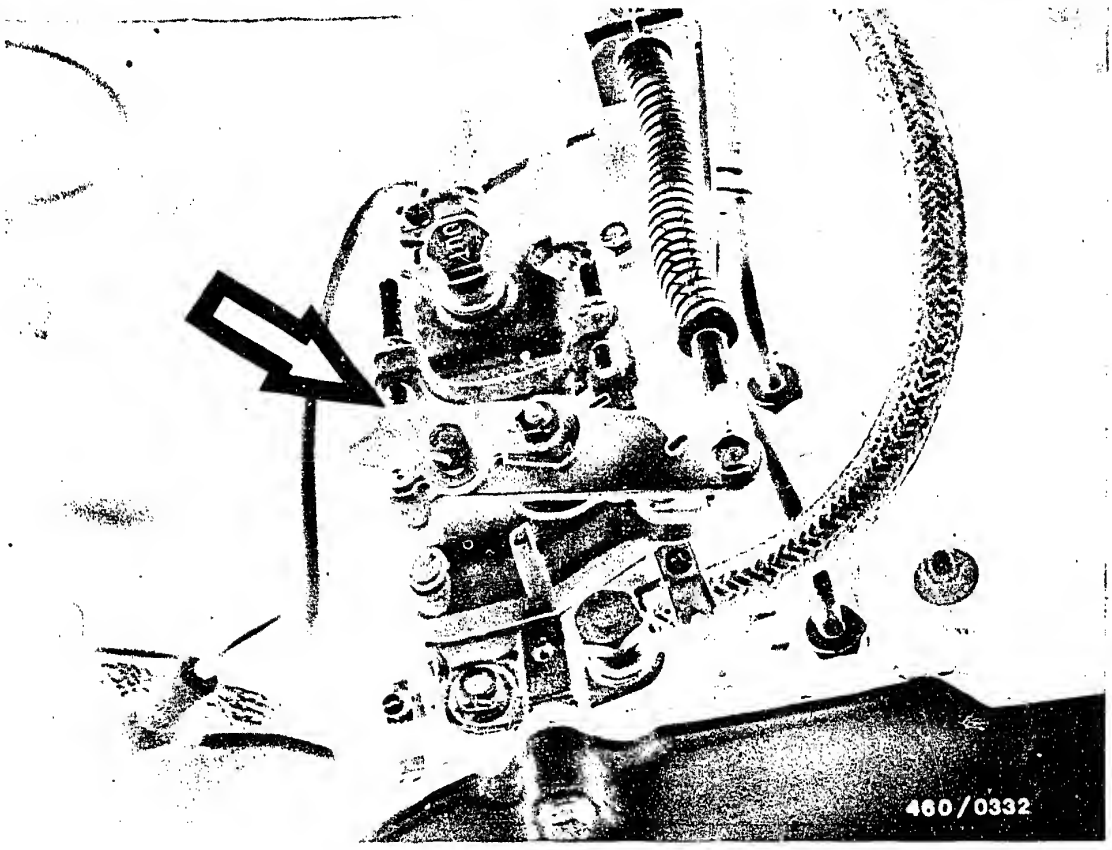
15.2 Check air filter

Remove air filter and subject to a visual inspection.

Test criteria for air filter:

- Dusty air filter (test by knocking out air filter)
- Oiled-up air filter
- Solid matter in air filter, e.g. leaves

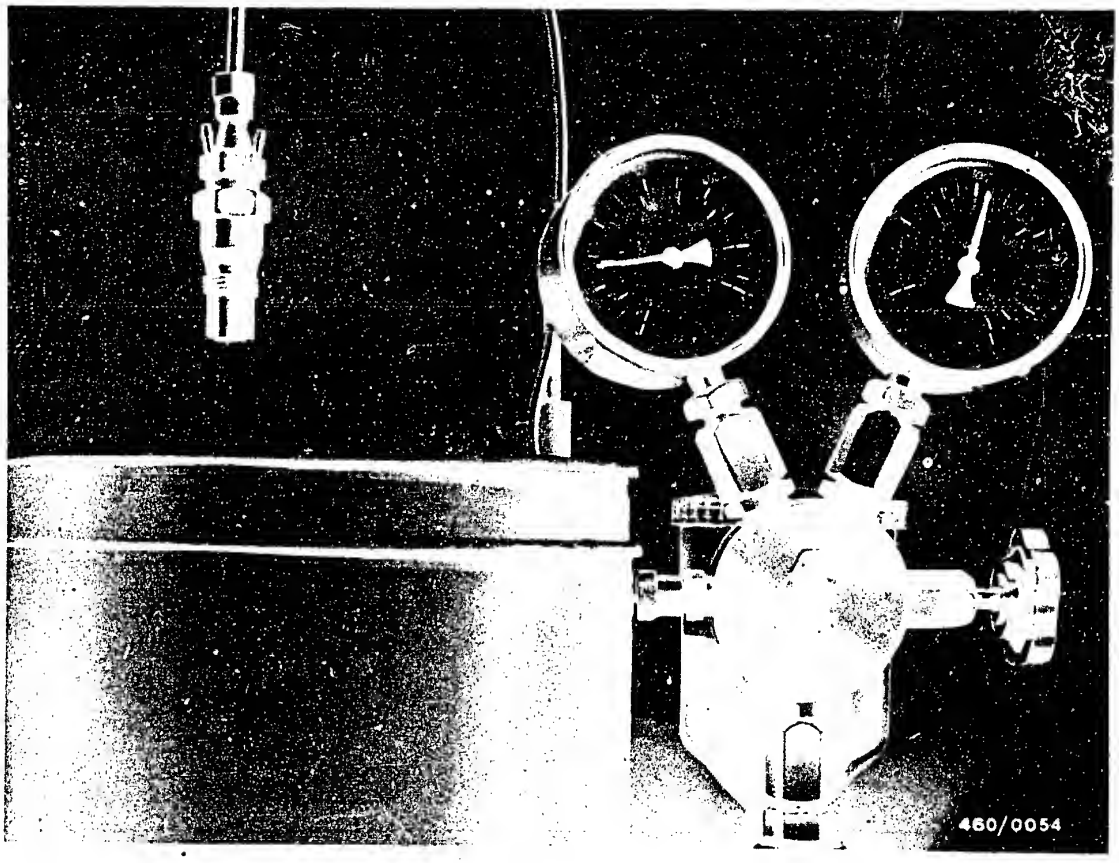
If in doubt, use new filter element.



16. Adjust idle speed

Connect tachometer (e.g. photoelectric) to engine.
Start engine and run at idle speed.

Caution:
In order to adjust the idle speed the engine must be at normal operating temperature.
Coolant temperature 80°C.
Set engine speed at idle-speed-adjusting screw (arrow) to 750 ± 25 min^{-1}.
Note that the camshaft and the injection pump are driven at half the engine speed.
After adjusting, lock and seal the adjusting screw.



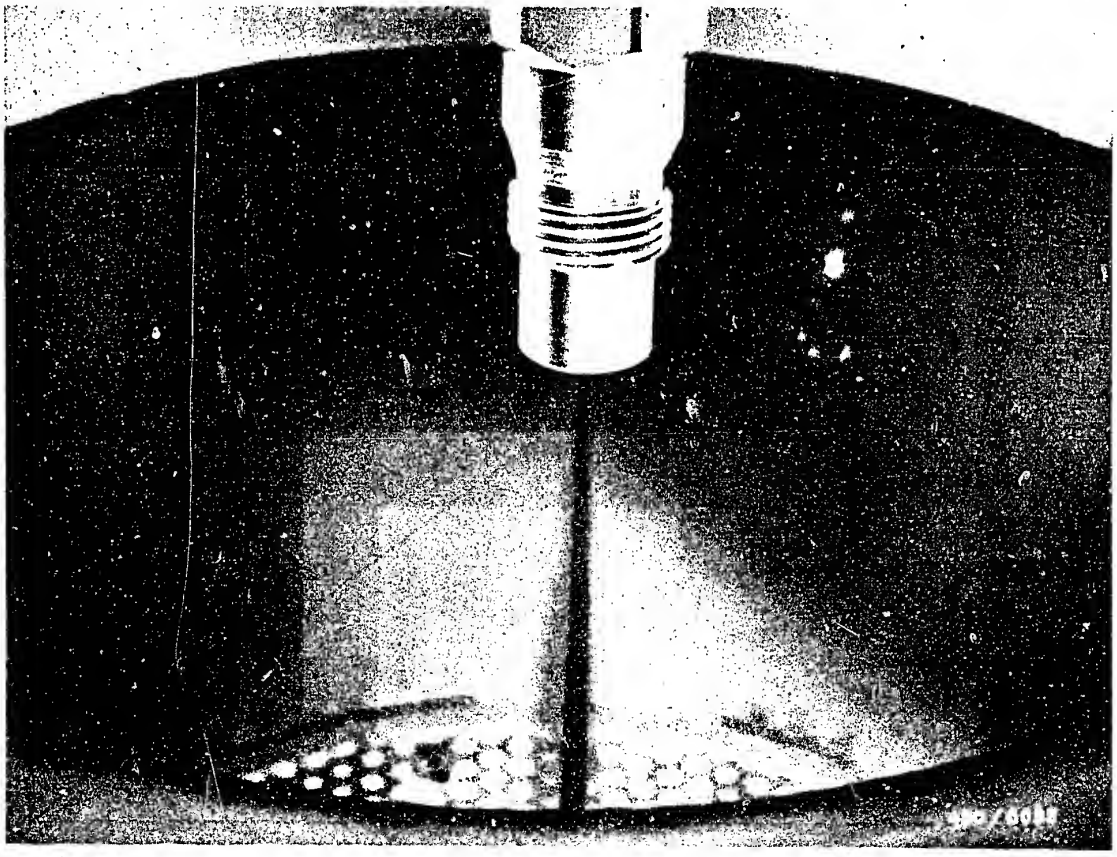
17. Test injection nozzles

Remove injection nozzles.

The test is performed using the nozzle tester EFEP 60 H 0 681 200 502.

Mount injection nozzle with nozzle-holder assembly on nozzle tester.

Caution:
When testing injection nozzles, make sure that the fuel spray does not strike your hands since, due to the high pressure, the fuel will penetrate into the skin and may cause blood poisoning.



17.1 Spray test

Switch off pressure gauge.

The spray pattern cannot be assessed until when the lever is being operated quickly (approx. 4-6 strokes per second). The spray must be quite concentrated and break off cleanly.

17.2 Chatter test

The pressure gauge is switched off.
Fully depress the lever of the tester slowly (1-2 strokes per second).
Nozzles in good working order must chatter when fuel escapes.

17.3 Check injection pressure

Switch on pressure gauge.
Slowly force lever downwards. When nozzle begins to squirt, read off injection pressure.
In the case of deviations from the nominal value, the nozzle-opening pressure must be adjusted by shims behind the pressure spring in the nozzle-holder assembly.

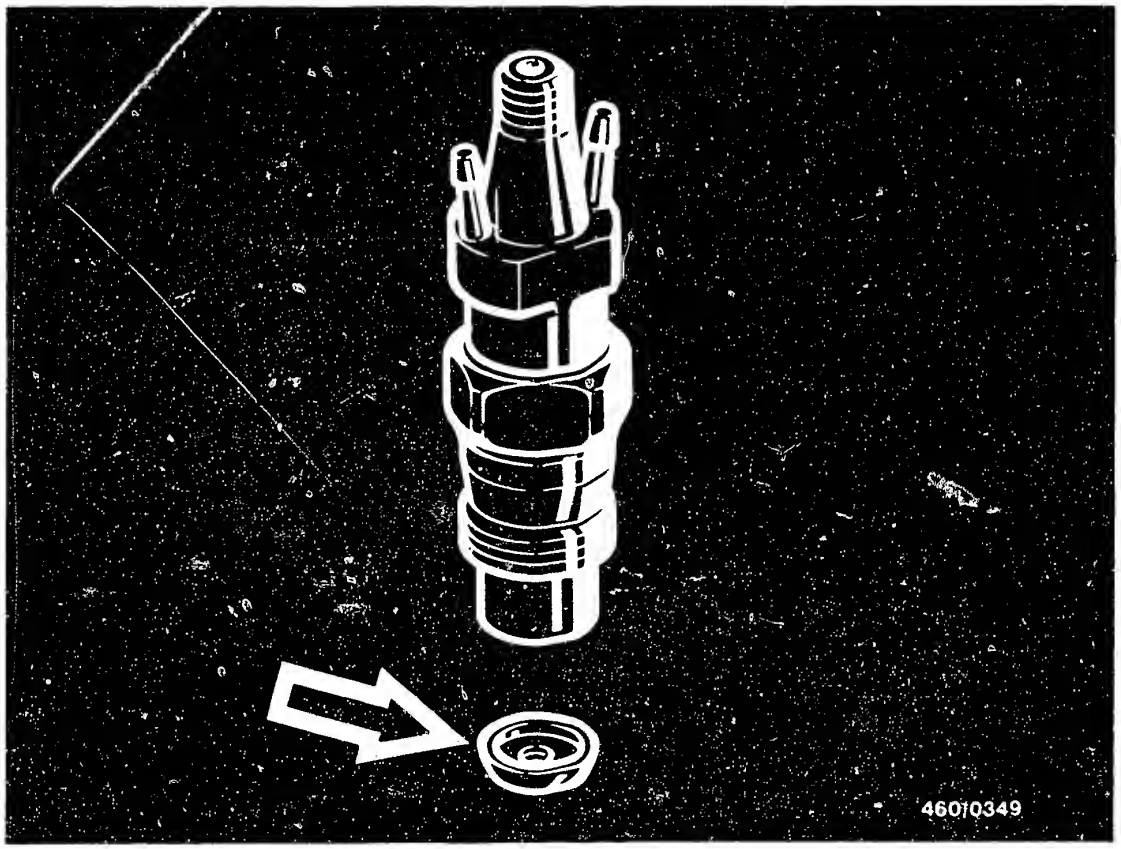
Nominal value: 130+8 bar

Thicker shims = higher nozzle-opening pressure
Thinner shims = lower nozzle-opening pressure

Increasing the spring travel by 0.05 mm causes a 5.0 bar increase in the nozzle-opening pressure.

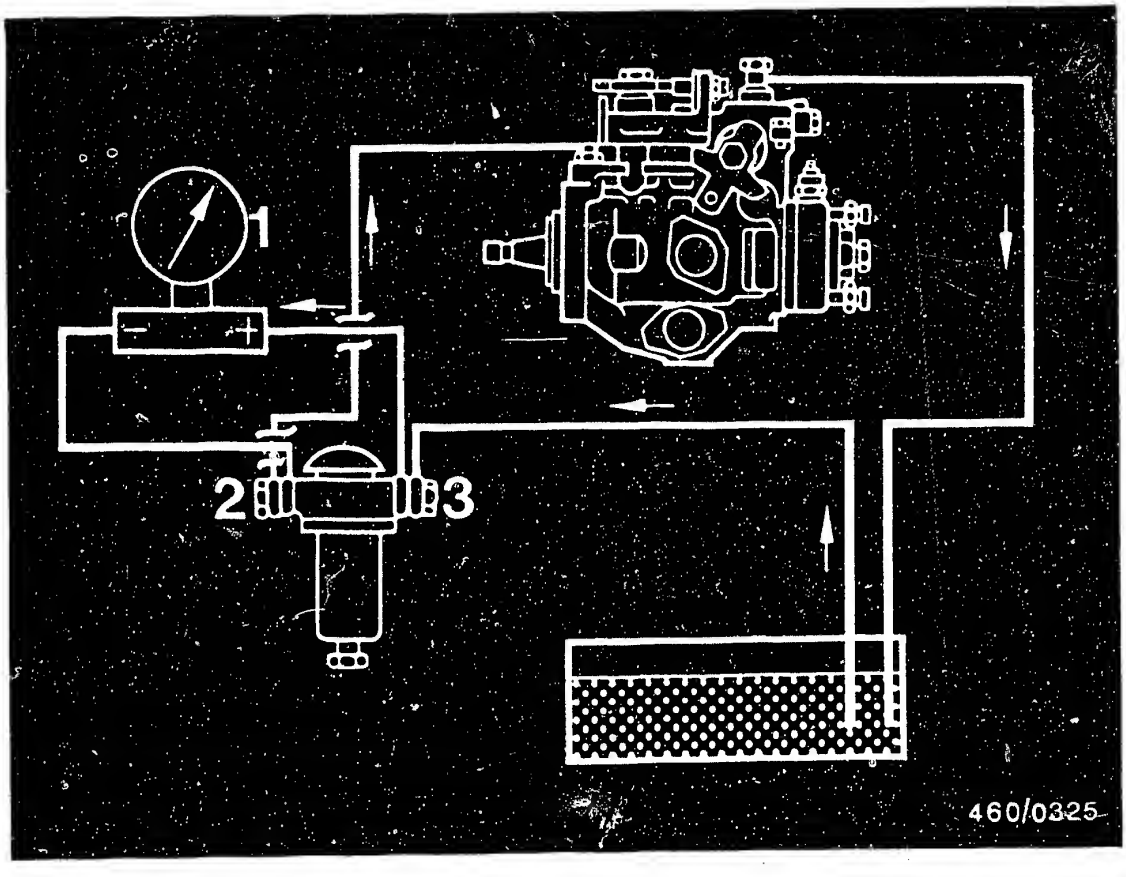
17.4 Leak test

Pressure gauge switched on.
Slowly force lever downwards and maintain pressure about 20 bar below opening pressure for 10 seconds. The nozzle must not drip during this period.



17.5 Fit injection nozzles

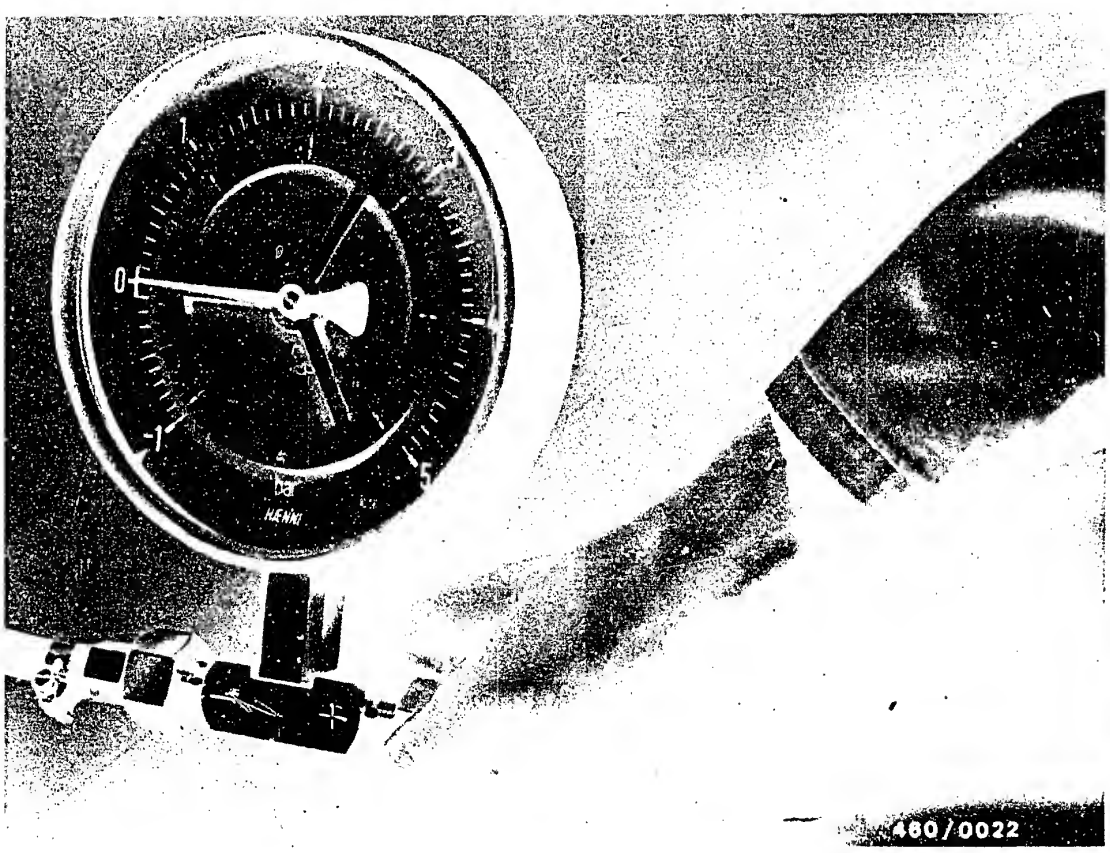
Before fitting the injection nozzles, fit a new heat seal (arrow).
Make sure that the installation position is correct.
Tighten fastening screws of nozzle-holder assembly to 39 Nm (3.9 kgfm).



1 = Differential-pressure gauge
2 = Filter outlet (use inlet union and extra-long inlet-union screw 2 443 456 020).
3 = Filter inlet (use inlet union and extra-long inlet-union screw 2 443 456 020).

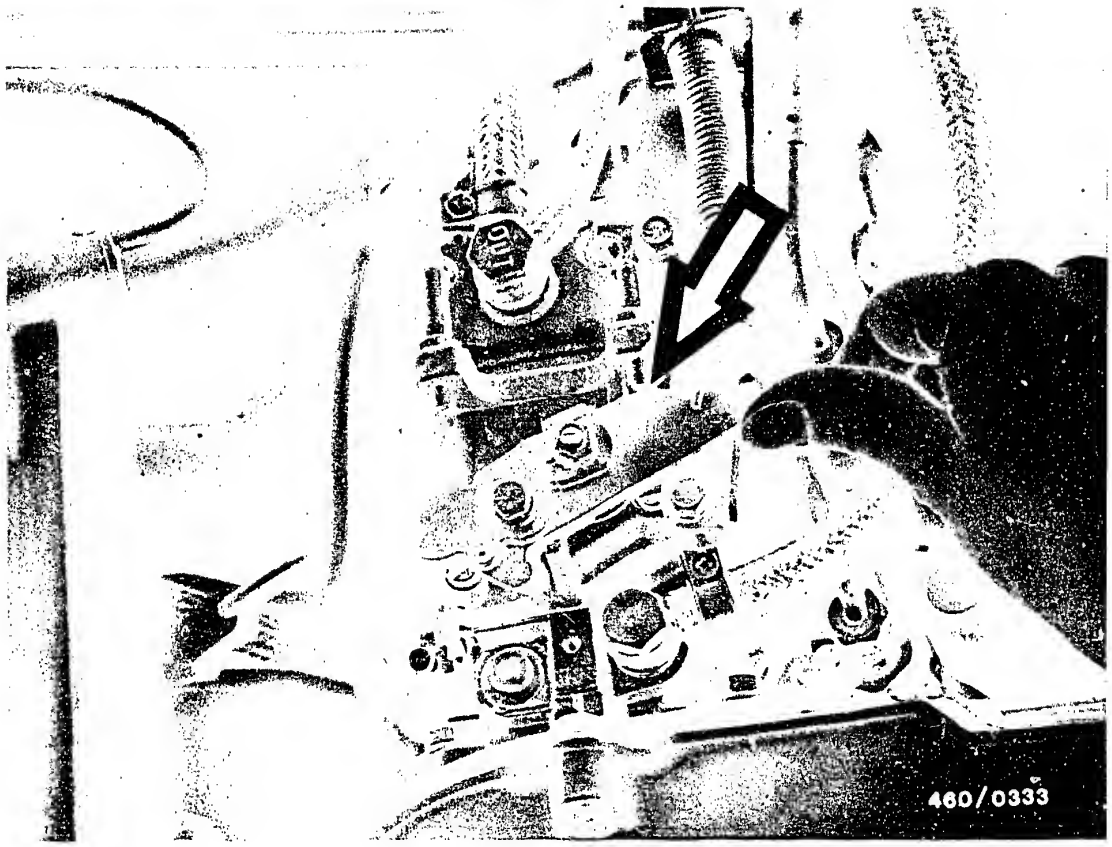
18. Check fuel filter

Connect differential-pressure gauge to fuel filter using appropriate connecting pieces.



Connect the (+) side of the differential-pressure gauge to the fuel filter inlet. Fit the (-) connection of the pressure gauge to the filter outlet. See connection diagram.

Run engine until you are sure that there is no air in the fuel system.



Move control lever of fuel-injection pump briskly (approx. 1 second) from idle stop to maximum-speed stop.

Release control lever and read off differential-pressure on pressure gauge.

The maximum permissible differential pressure is 0.3 bar. If this value is exceeded, replace filter.
Remove test connections.

If necessary, bleed fuel system.

19. Check pre-heating system

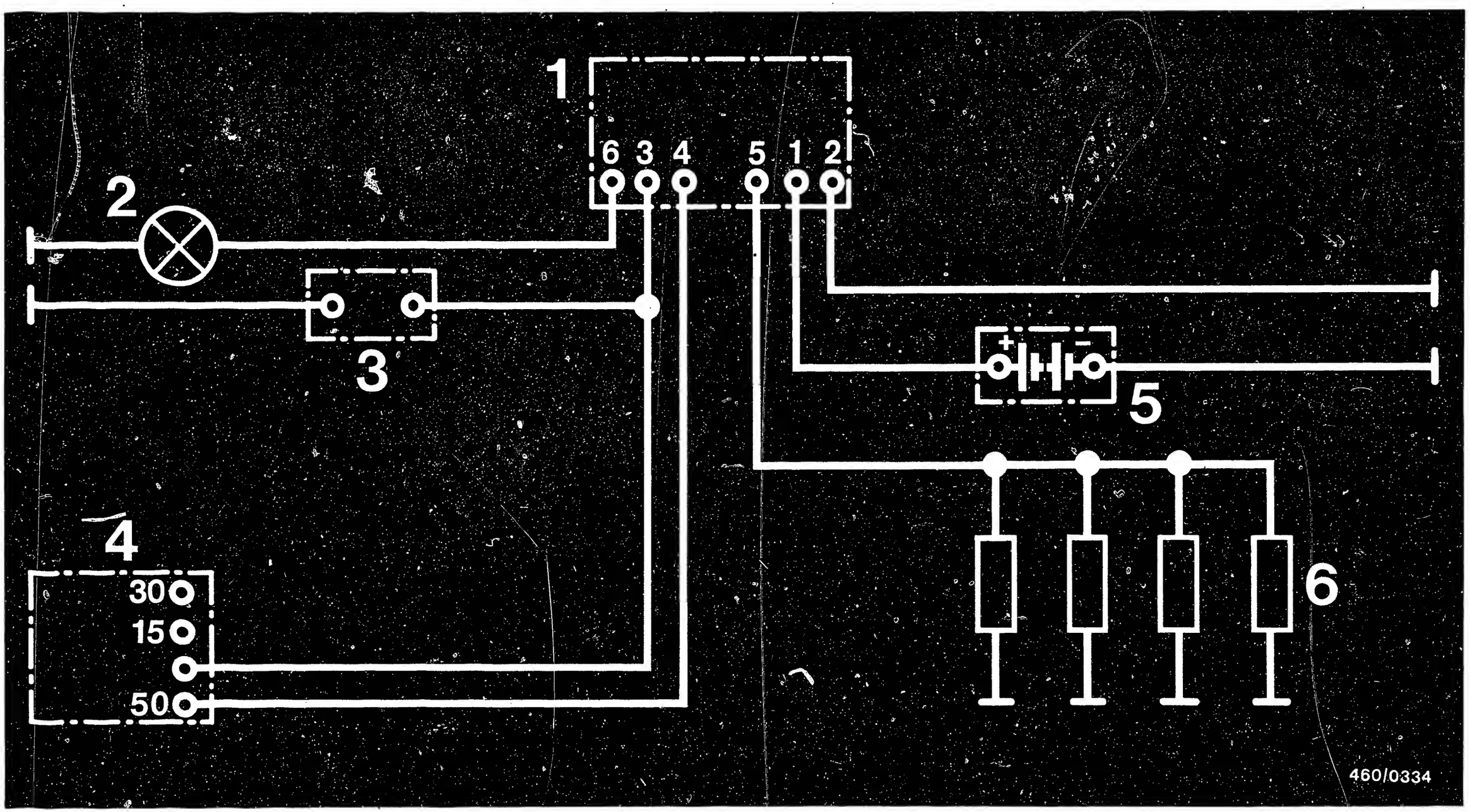
19.1 Necessary test equipment

Voltmeter	e.g. MOT 002.00	0 684 000 200
Ohmmeter	e.g. ETE 014.00	0 684 101 400

19.2 Workshop information

19.2.1 We recommend that the "R"-type sheathed-element glow plugs be replaced every 45,000 km.

19.2.3 Pre-heating times
The pre-heating time is dependent on the ambient temperature.



19.3. Terminal diagram for pre-heating system

1 = Glow-duration relay
2 = Visual indication
3 = Solenoid-operated valve
4 = Glow-plug and starter switch
5 = Battery
6 = Sheathed-element glow plugs

20. Check timing device

In distributor-type fuel-injection pumps VE..F.. the timing device is integral with the fuel-injection pump.

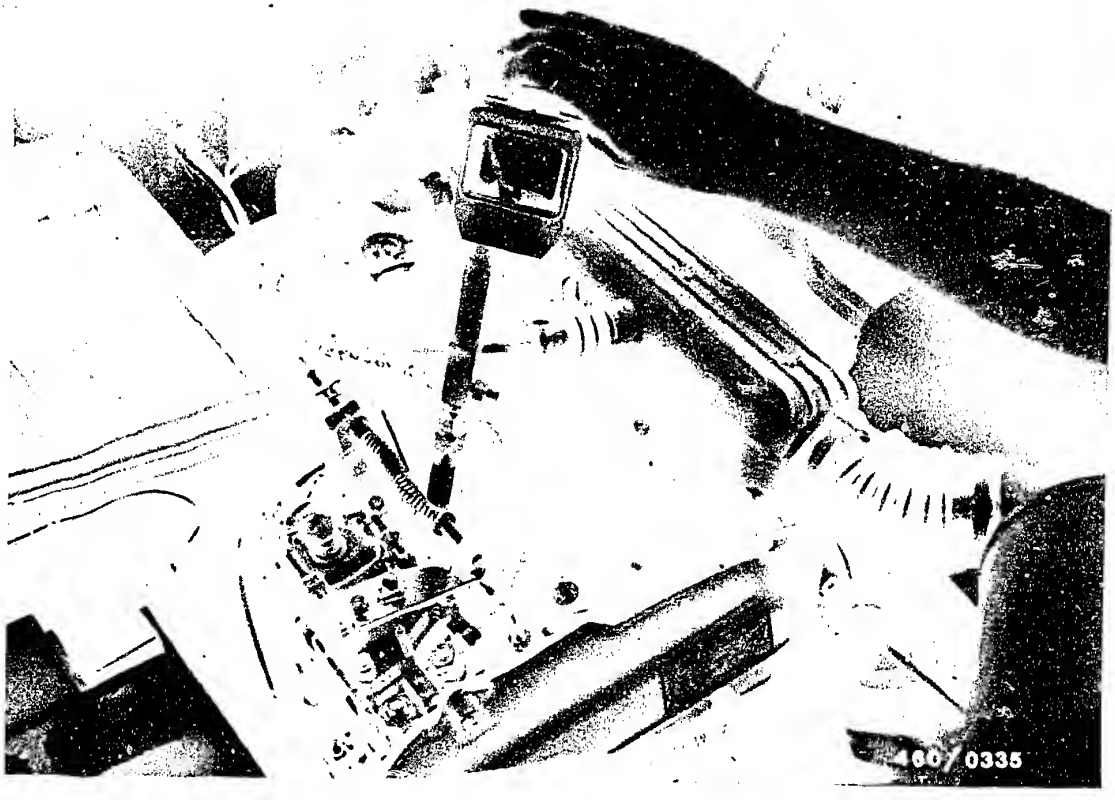
In order to test the timing device, it is necessary to remove the fuel-injection pump.

Perform the test on the injection-pump test bench.

21. Measure engine compression and compression loss

21.1. Measure engine compression

Fit new chart in compression tracer. Mount high-pressure hose on tracer. Switch off engine.
In order to prevent fuel from being injected, remove connecting cable from shutoff magnet on distributor-type fuel-injection pump (picture).



Using the starting motor, turn over the engine several times so that loose deposits are removed from the compression space.

Screw in connecting nipple.

Fit high-pressure hose of compression tester onto connecting nipple.

During the following operation, note first compression stroke.

Operate starting motor until there is no longer any detectable rise in pressure on the compression tracer.

Bleed compression tracer by pressing on bleeder valve.

The pointer returns to the starting position.

Move chart onto next position.

Fit connection nipple to the other cylinders and repeat measurement.

21.1.1 Evaluation of chart

1. Normal pressure rise

If piston rings and valves are in good condition, the first compression stroke shows the highest pressure increase.
During the following compression strokes the compression builds up to the maximum pressure.

2. Gradual pressure rise

If, from the start, the compression increases only gradually on each piston stroke, this points to burnt valve seats or defective valve guides.

3. Low maximum pressure

If the maximum pressure obtained is too low on all cylinders, this points to defective pistons, piston rings or valves.
If the compression is too low on two neighbouring cylinders, this points to a leaky cylinder head gasket.

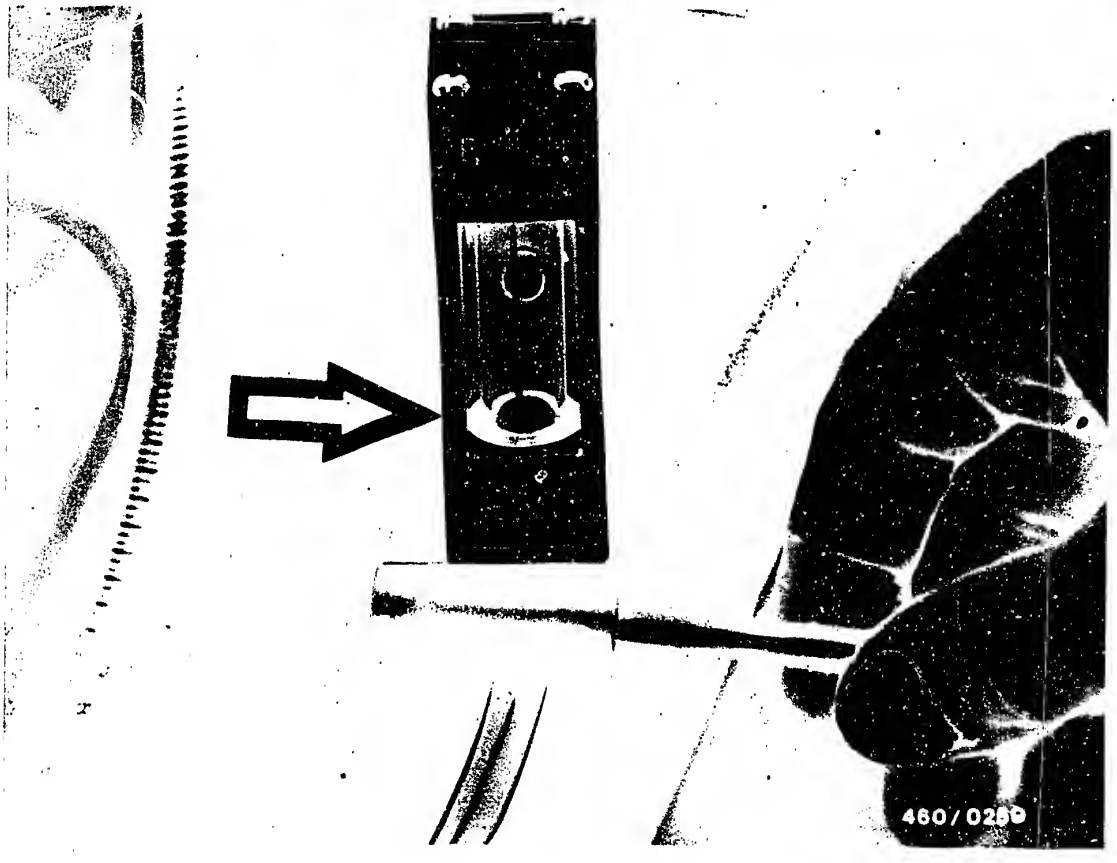
4. Varying compression

If one cylinder shows a clearly lower compression, proceed as follows: fill in 2-3 cm^3 of engine oil through the opening of the sheathed-element glow plug or nozzle-holder assembly and operate starting motor briefly.

Repeat measurements and compare charts. If there is a clear increase in compression during the second test, then the piston rings or cylinders are worn.
If there is no change in the result, then defective valves are the cause.

5. Uniform compression

Uniform compression is extremely important with regard to the smooth running of the engine. Maximum compression is, therefore, not the only objective.



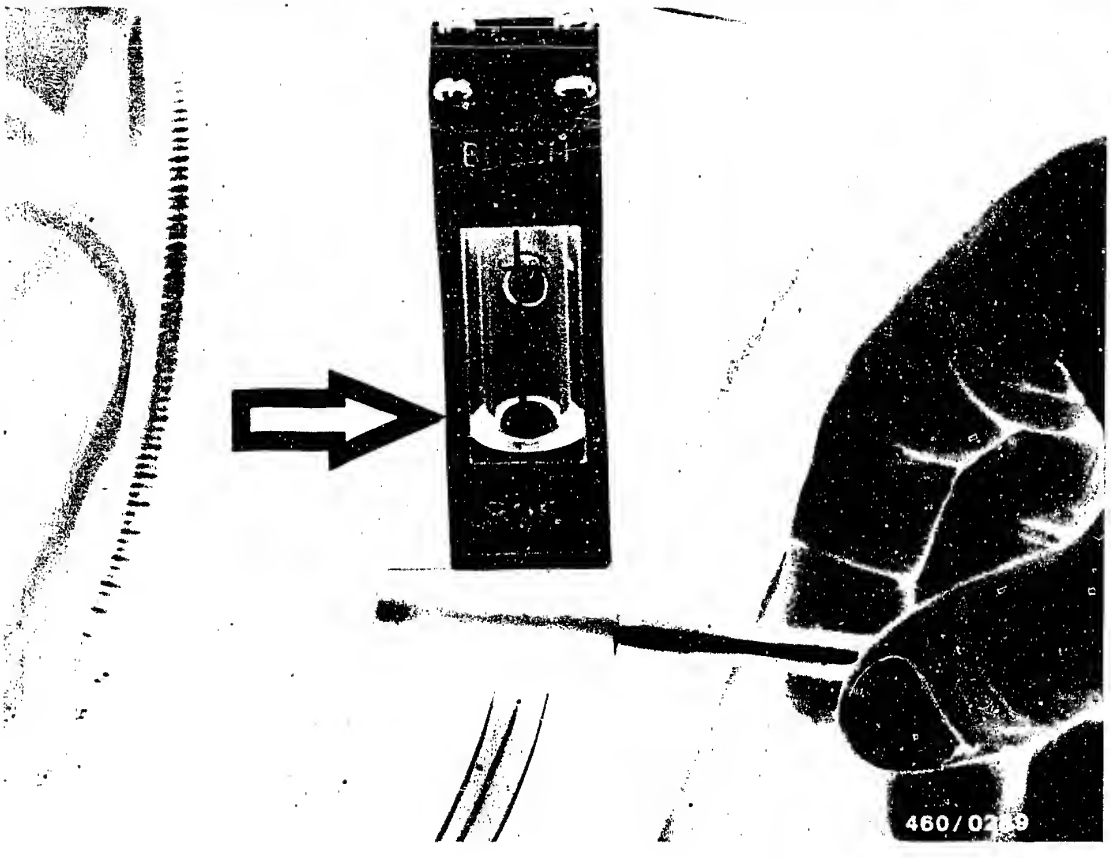
21.2 Measure compression loss of engine

The test is performed using the Bosch compression-loss tester 0 681 001.901 (EFAW 210 A).

For testing, the respective piston must be at TDC (TDC = top dead centre) on the compression stroke.

For setting this position, use DC detector 1 688 132 025 (included in accessories with compression-loss tester).

Perform test with engine at normal operating temperature (temperature of water approx. 80 °C).



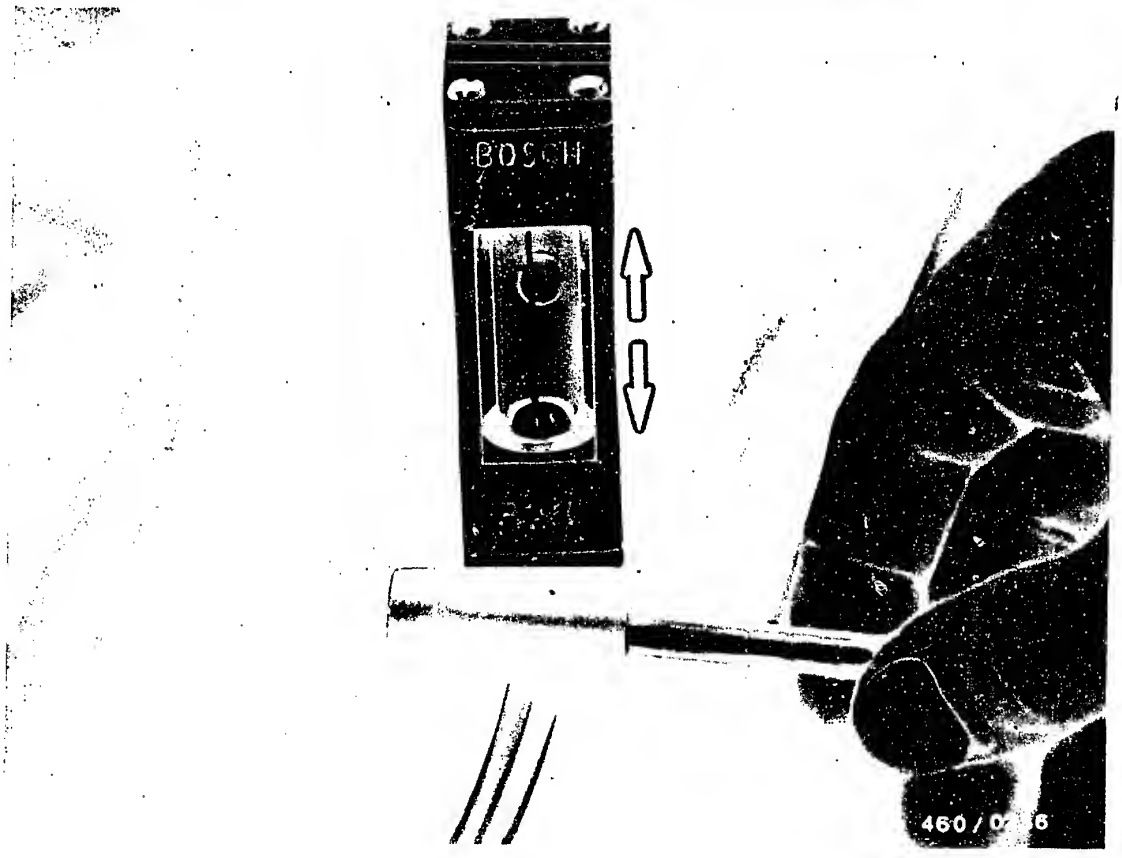
21.2.1 Set top dead centre

Remove sheathed-element glow plug from cylinder 1.

Insert rubber plug of DC detector into bore for sheathed-element glow plug.

Using magnetic clamp, mount glass cylinder in as vertical a position as possible in the engine compartment. The piston of the unit must be easily visible.

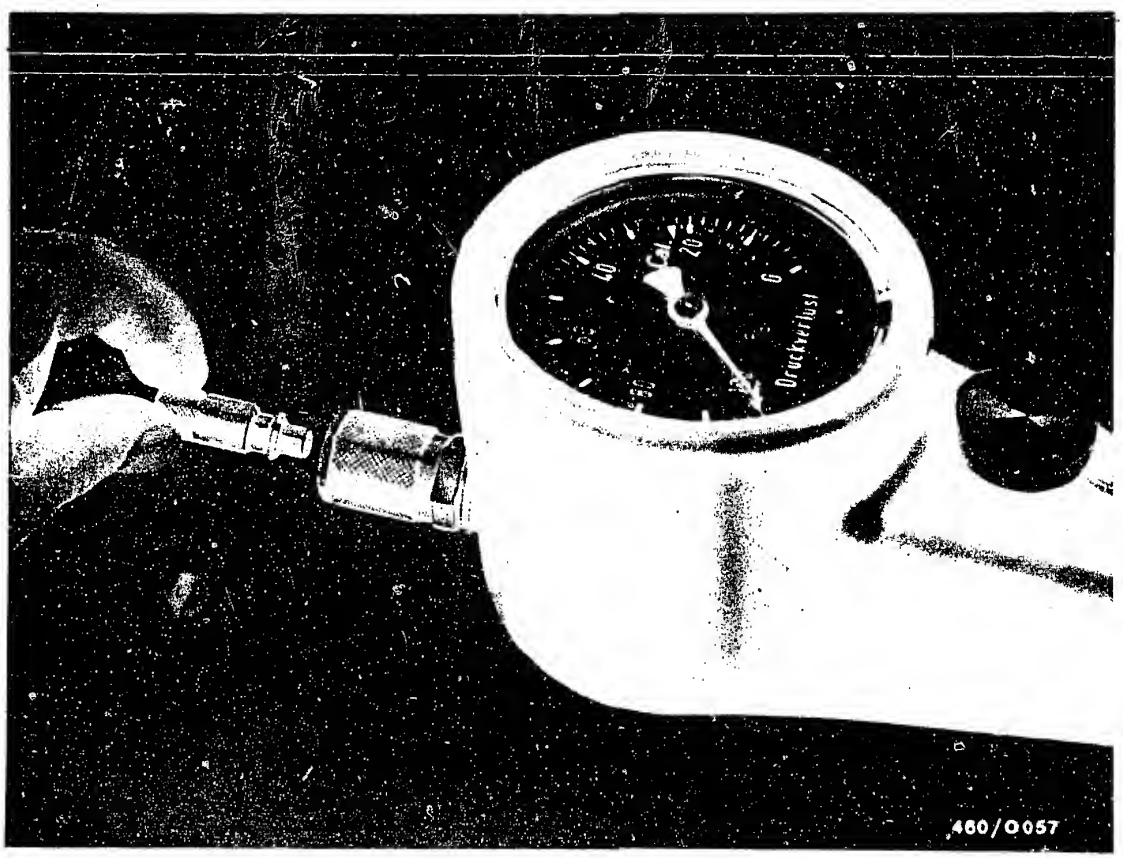
Slowly turn the engine over by hand in its direction of rotation. (If necessary, select gear and push vehicle).



On the compression stroke, the piston of the DC detector is forced upwards.

As top dead centre is passed over, the piston slides down again immediately.

Locate top dead centre by carefully turning the engine backwards and forwards.

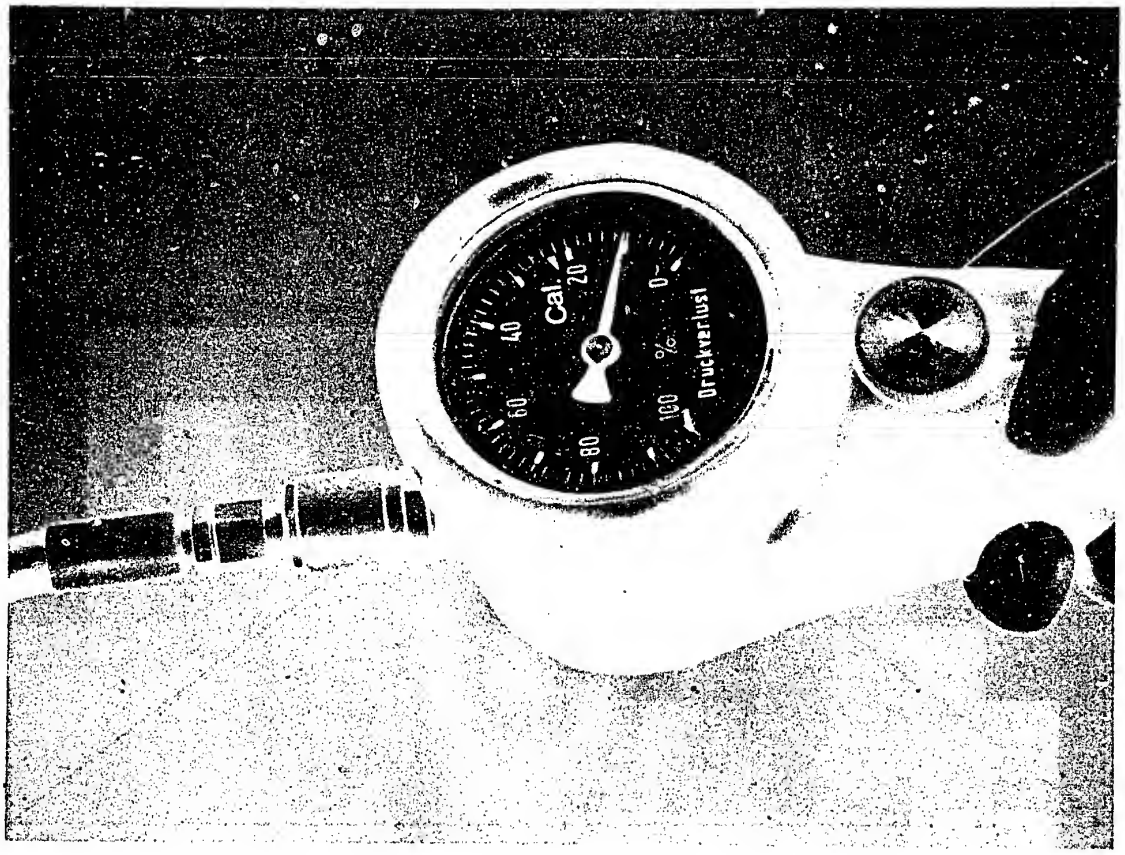


21.2.2 Measure compression loss

Connect tester to compressed-air mains.

Connect calibrating nozzle 1 680 363 036. Set a compression loss of 23 ± 1% (marking "Cal".) at the knurled thumbscrew on the pressure-regulating valve. Disconnect calibrating nozzle.

(Instrument indicator must show approximately 0% compression loss - equipment check.)



Screw in fitting and mount test hose.
Select gear and pull on handbrake.
Connect test hose to tester.
Read off compression loss in % on instrument.

Note:
Before testing the next cylinder, turn the engine over briefly without pre-heating using the starting motor so that the oil film re-forms.

21.2.3 Evaluation of test

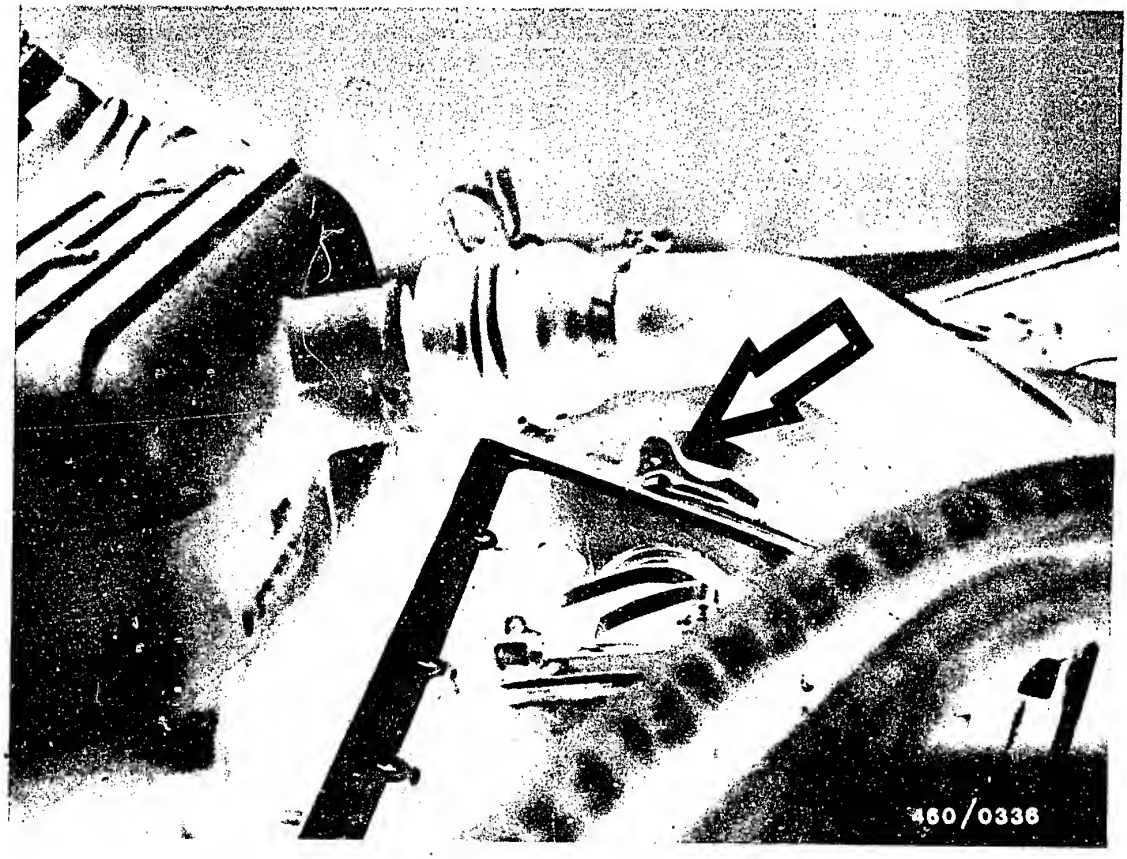
The compression loss indicated should not exceed 25%.

Differences of 10% between the individual cylinders can be ignored.
The causes of greater losses can be located because the air makes a noise as it escapes.
Listen at the following points:

Location of noise	Possible trouble
Intake manifold (remove air filter)	Intake valve
Exhaust manifold	Exhaust valve
Oil filler neck on engine	Pistons, piston rings
Cooling water filler neck (air bubbles)	Cylinder head gasket

In order to trace the trouble even more accurately, fill approximately 2-3 cm^3 of engine oil into the cylinder.
Repeat test.
If there is a clear decrease in compression loss during this test, then the fault lies with the piston or with the piston rings.

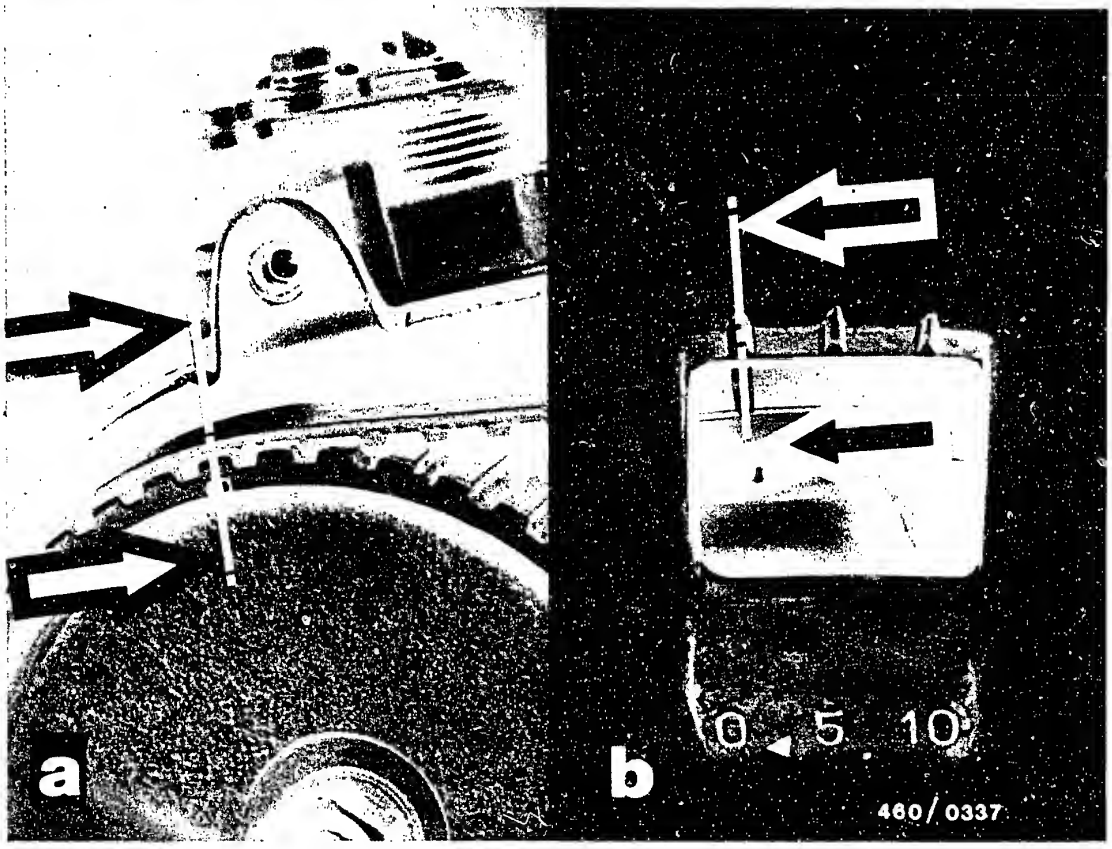
New engines which have not yet been run in (less than 5,000 km) may show higher compression losses than after the running-in period.



23. Work on the fuel-injection pump

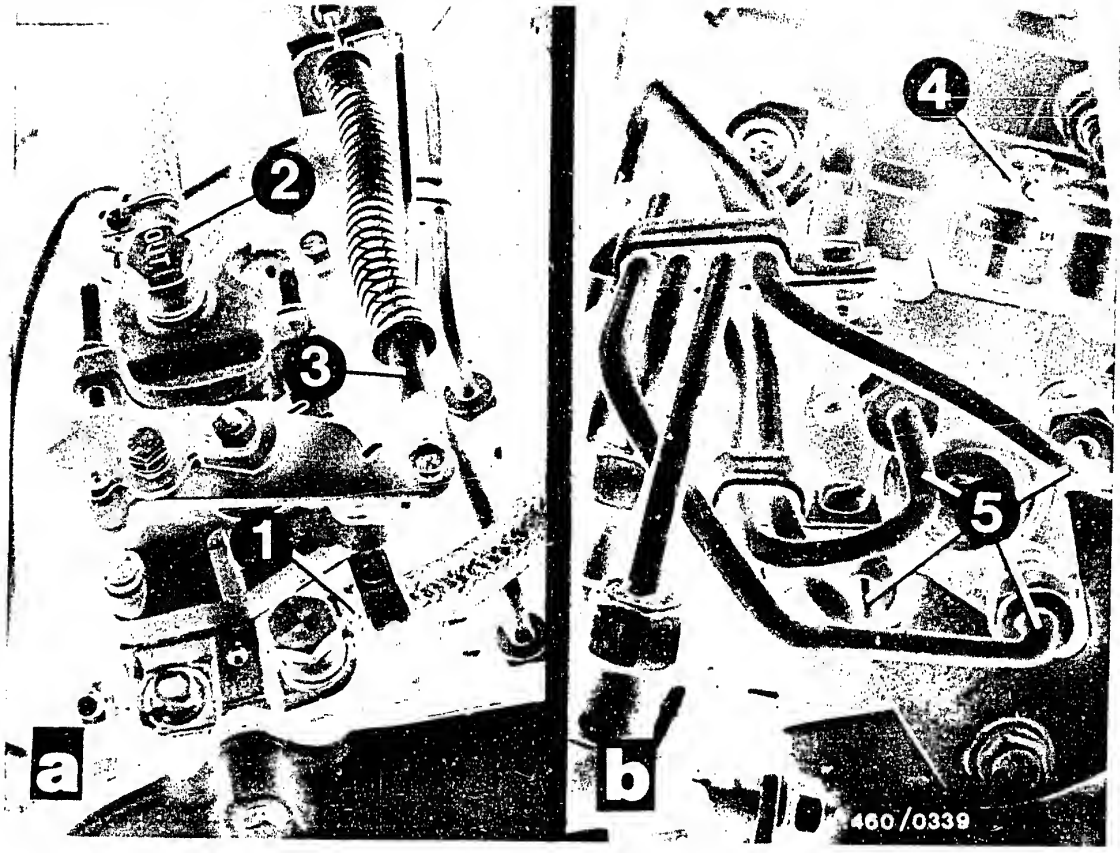
23.1 Remove fuel-injection pump

Disconnect the positive terminal of the battery. Remove cover for engine timing and injection-pump drive. Turn crankshaft so that the reference bore on the pulley is in alignment with the fixed mark on the cylinder head.

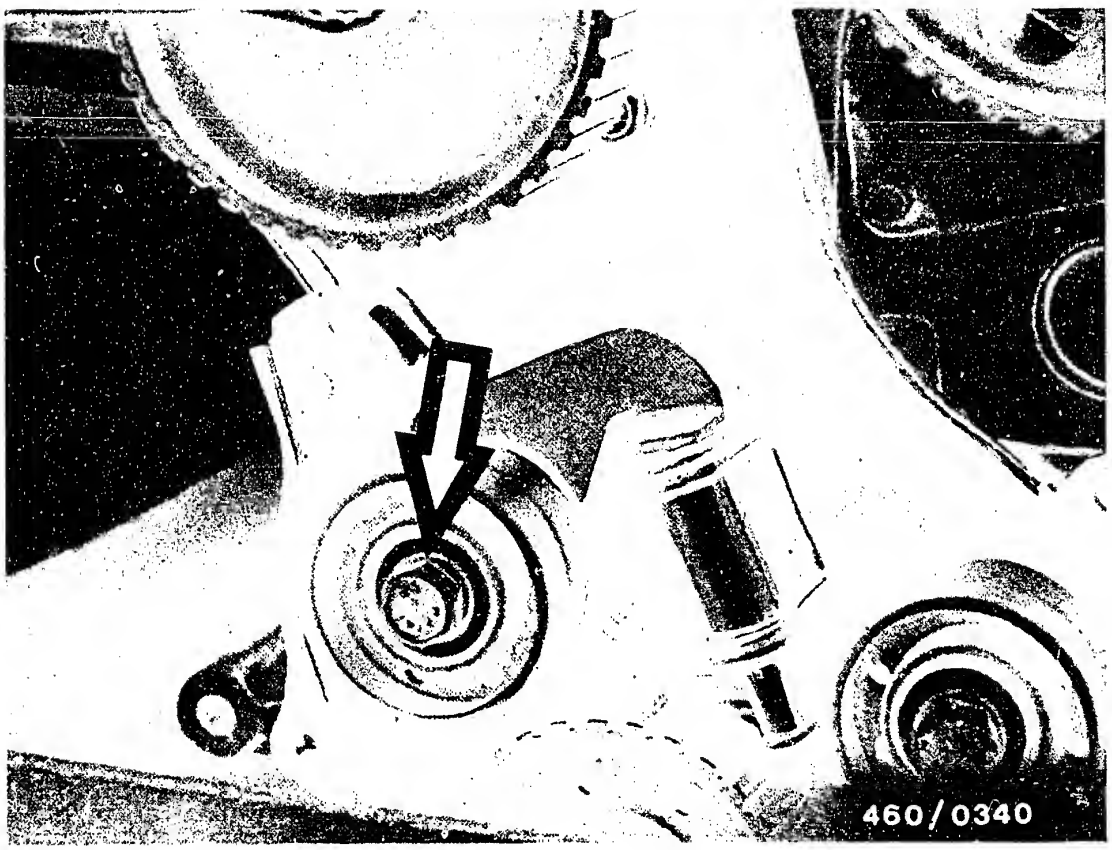


The mark on the pump drive gear points to the fixed mark on the toothed-belt guard cover. (Fig. a).

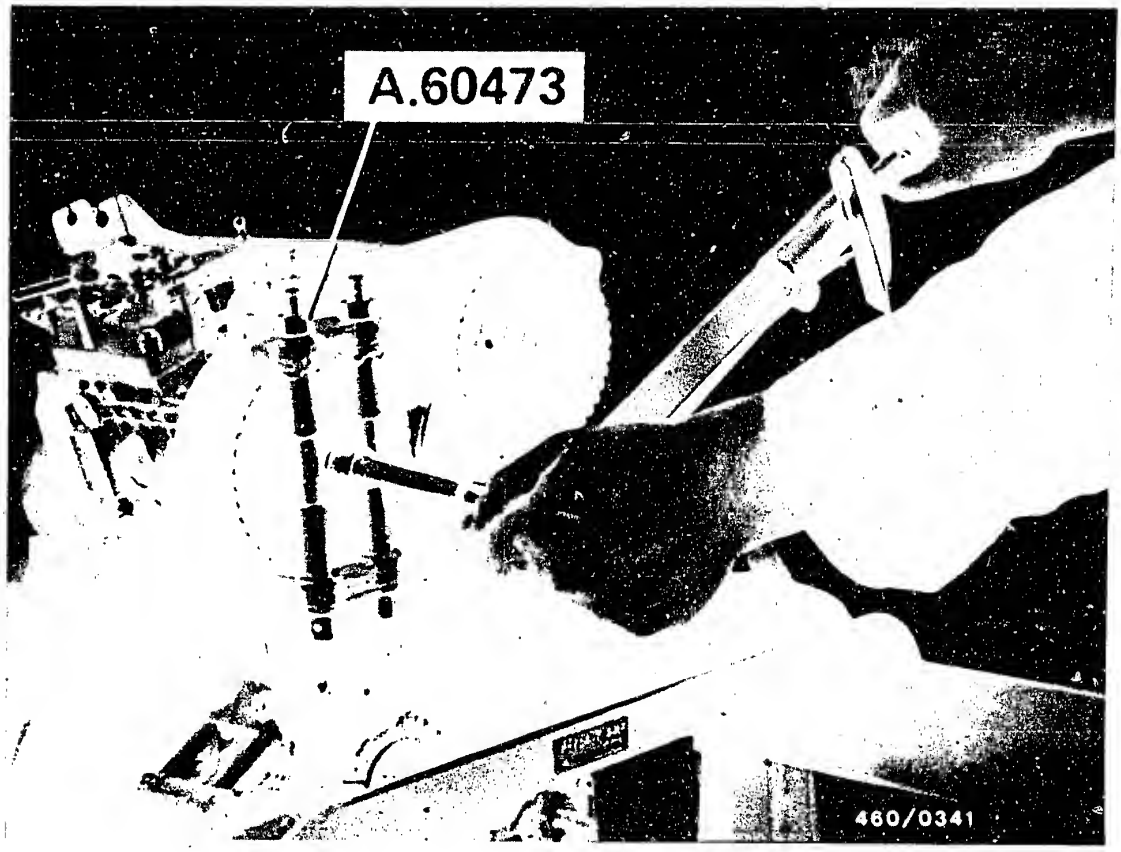
The TDC mark (cyl. 1) on the flywheel must be in alignment with the reference mark. (Fig. b)



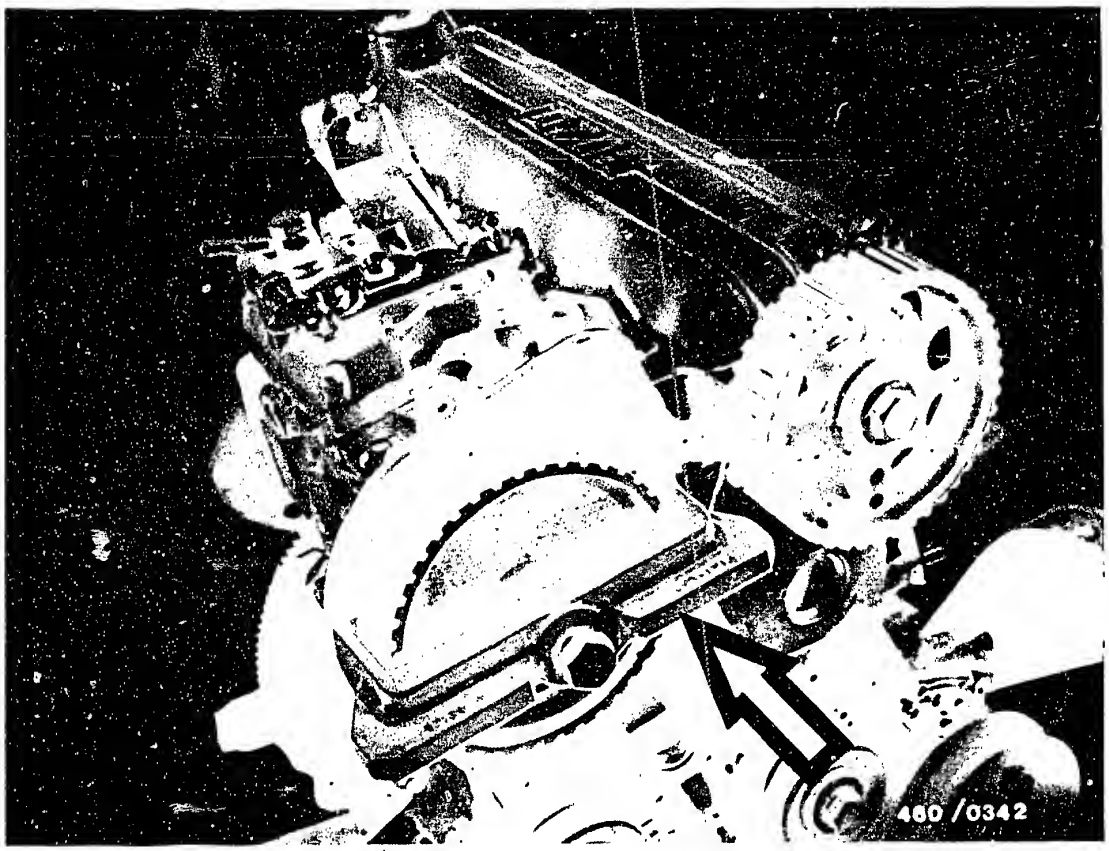
Remove fuel inlet line (1), fuel return line (2), cable (3) on control lever.
Remove electric lead (4) on shutoff solenoid and fuel-injection tubing (5) from injection pump.



Loosen fastening screw of belt tensioner roller (arrow). Press belt tensioner roller against the spring force of the belt tensioner until the toothed belt is relaxed. Remove toothed belt from camshaft gear.



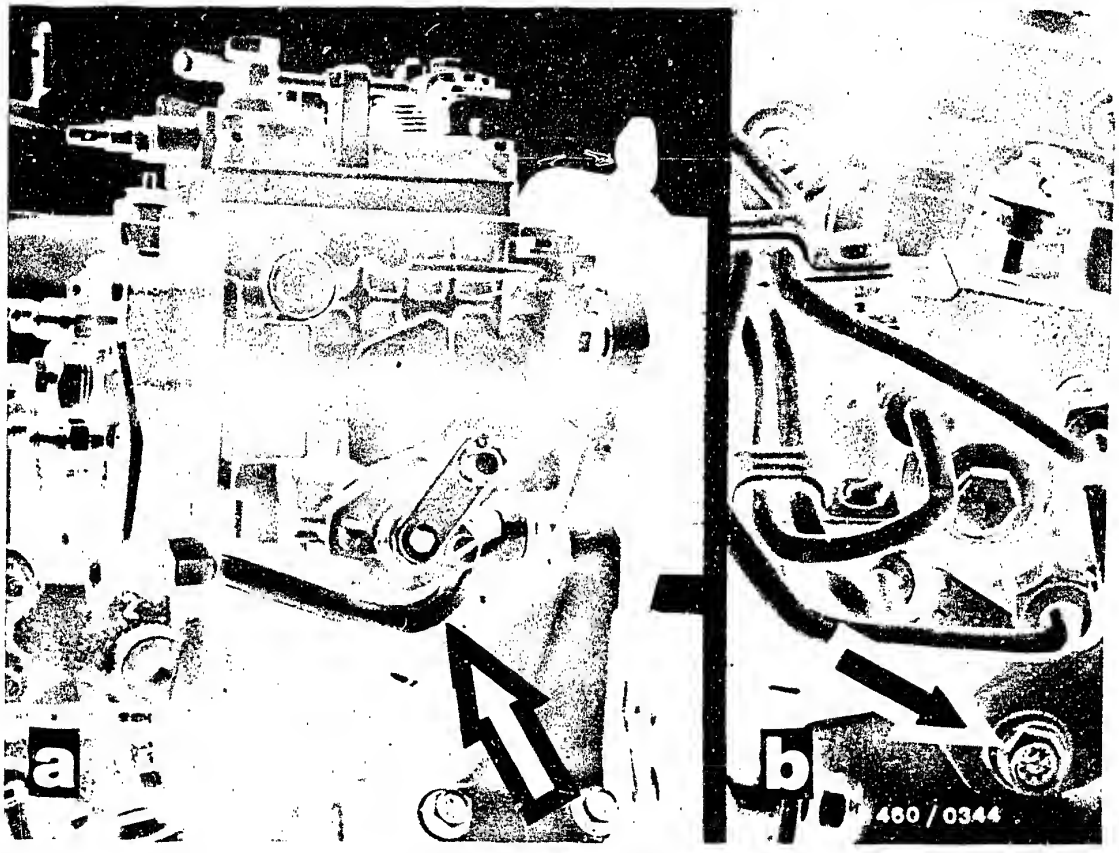
Mount holding device A. 60473 with part-piece A. 60473/10 on injection-pump drive gear.
Loosen fastening nut of injection-pump gear and unscrew by approx. 2 turns.



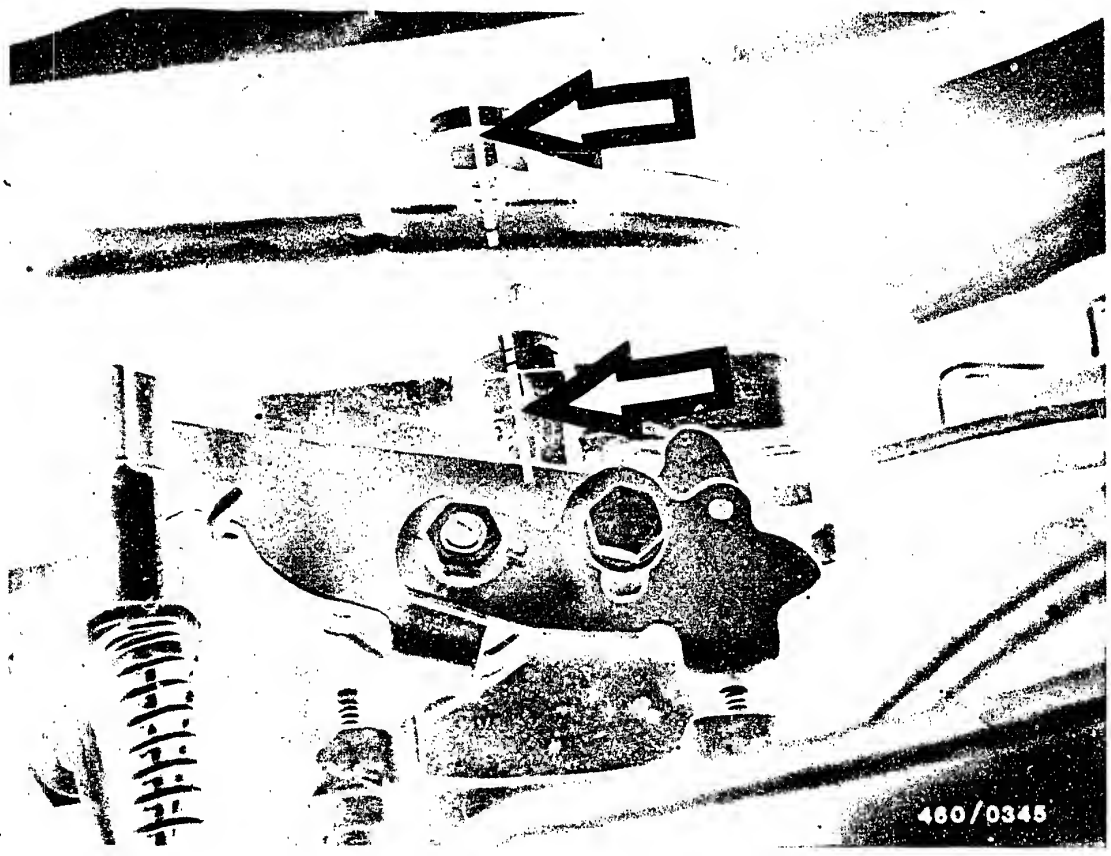
Remove holding device from injection-pump gear.

Mount puller A. 42129 (arrow) on pump drive gear. Pull off pump drive gear.

Remove puller A. 42129.
Unscrew fastening nut and remove injection-pump gear.

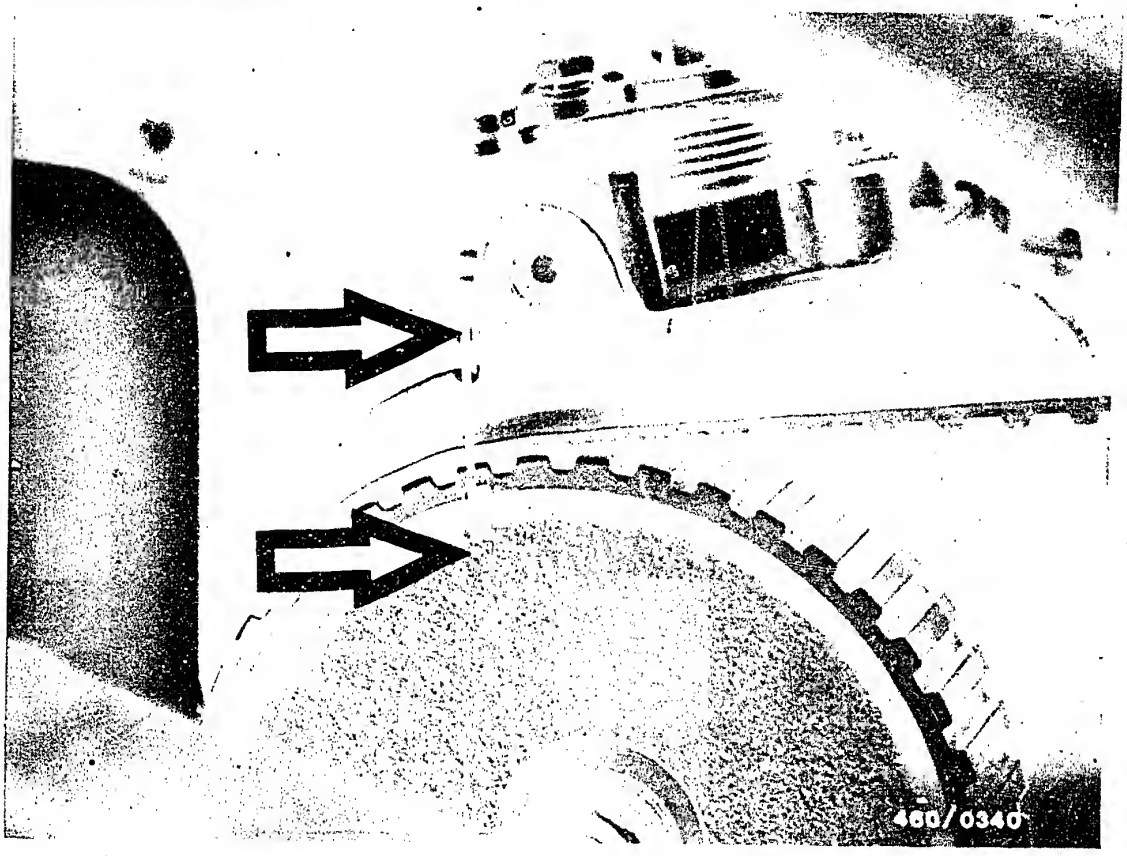


Remove fastening screws.
Remove lower fastening screw of injection pump using box wrench A. 65090 (Fig. a - arrow).
Remove fastening screw on support bracket of hydraulic head. (Fig. b, arrow)
Remove injection pump from engine.

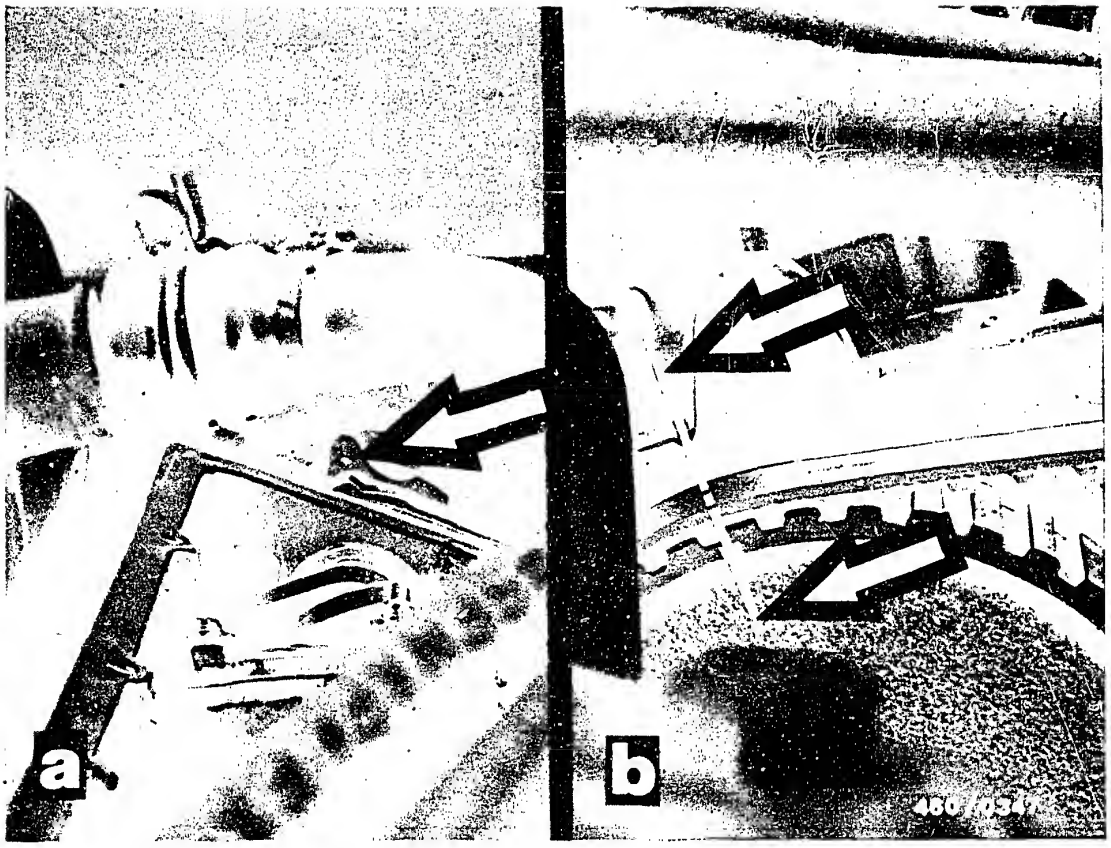


23.2 Install fuel-injection pump

Introduce fuel-injection pump so that the mark on the governor shaft and the threaded hole on the cover plate are in alignment.
Fit injection pump fastening screws and tighten slightly.

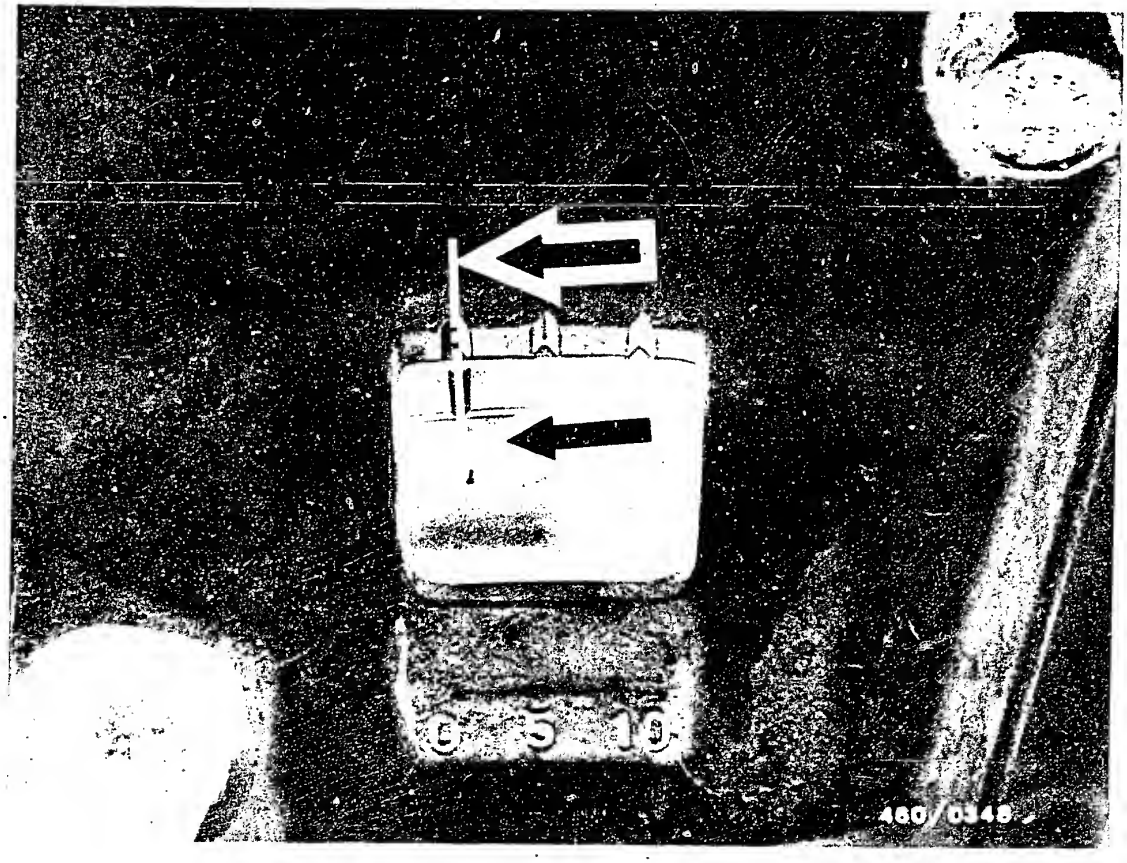


Mount injection-pump gear (Woodruff key in cone of pump drive shaft must be installed) and turn so that the mark on the injection-pump gear points to the fixed mark on the toothed-belt guard cover (arrows).
Screw on fastening nut of injection-pump gear with retainer. Fit holding device A. 60473 with part-piece A. 60473/10. Tighten hexagon nut of injection-pump gear to 49 Nm (4.9 kgfm).

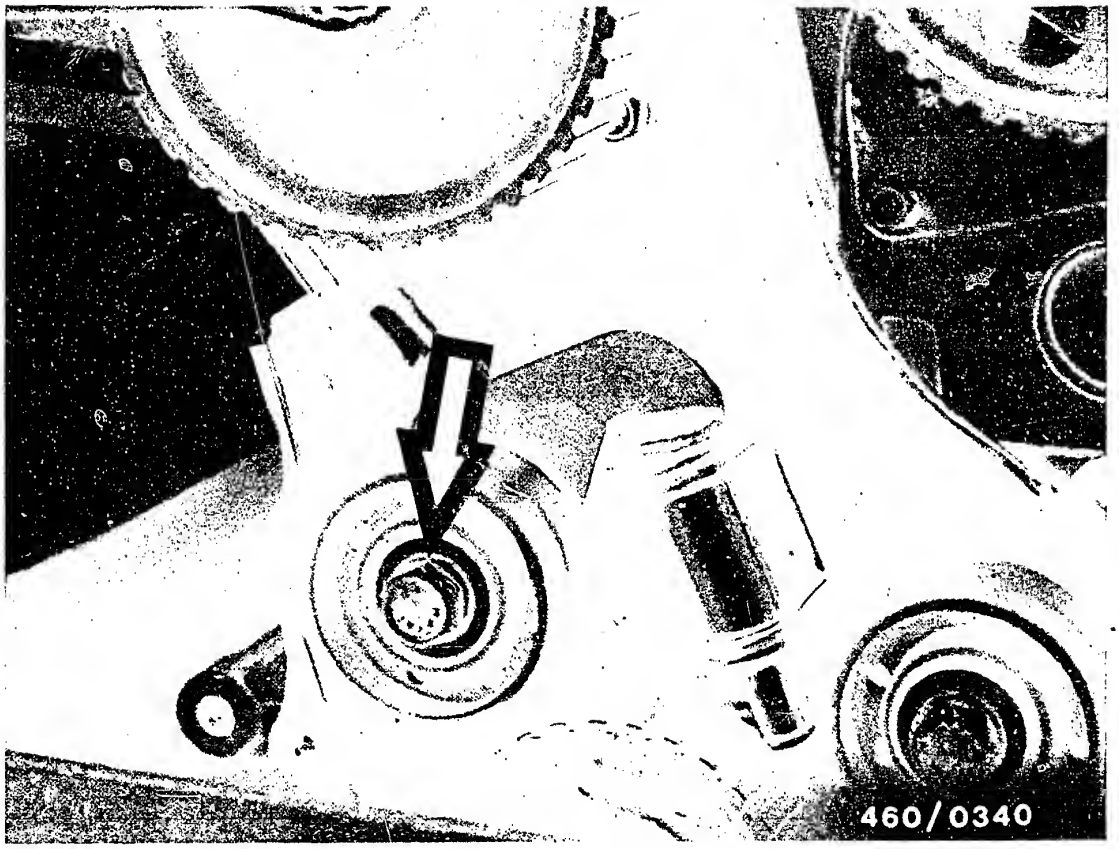


Place new toothed belt on injection-pump gear and camshaft gear.
The markings on the camshaft gear (a) and injection-pump gear (b) point to their reference points.

Caution
Whenever work on the injection pump involves removal of the toothed belt, it is necessary to install a new toothed belt.



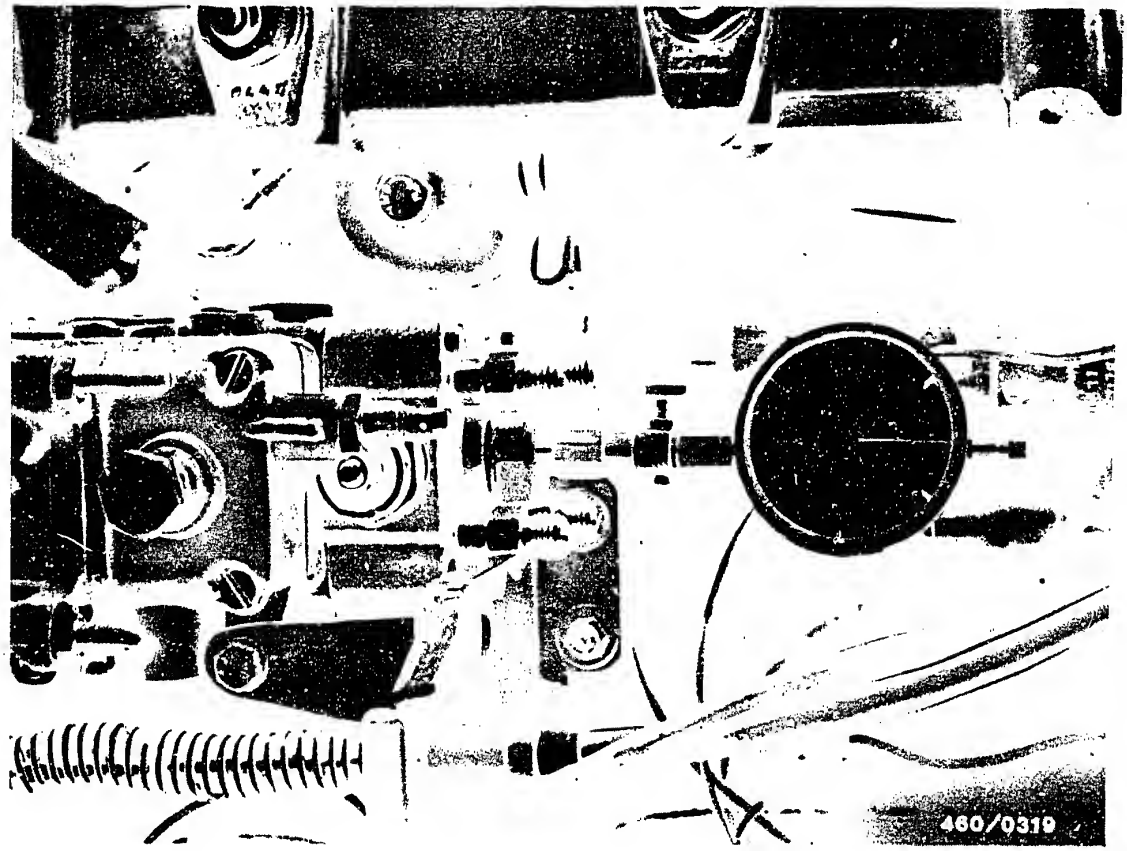
The TDC mark on the flywheel must be in alignment with the reference mark. (Arrows)



Loosen fastening screw of belt tensioner roller until the spring-loaded belt tensioner presses against the toothed belt.

Re-tighten fastening screw. Turn engine over two full times in direction of rotation of engine until the markings on the camshaft gear, injection-pump gear and the TDC mark on the flywheel are in alignment with the reference points.

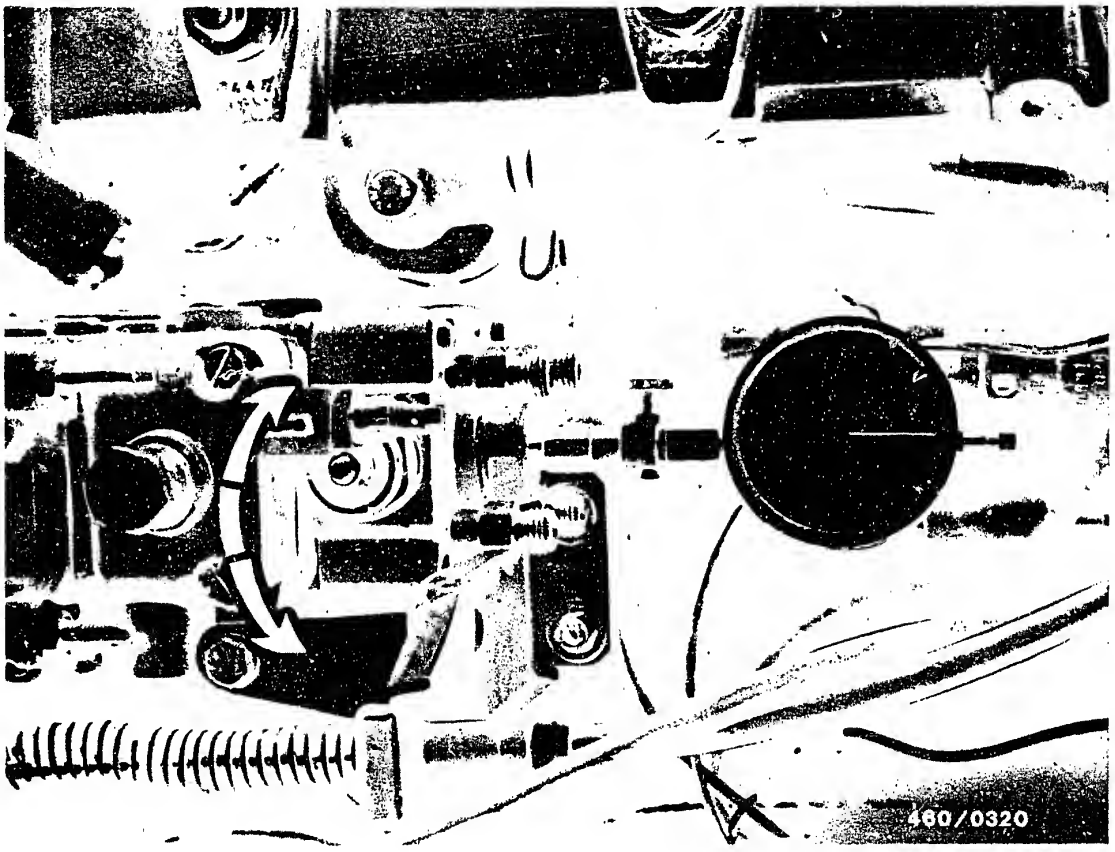
Loosen fastening screw of belt tensioner roller until spring-loaded belt tensioner presses against toothed belt. Tighten fastening screw to 56 Nm.



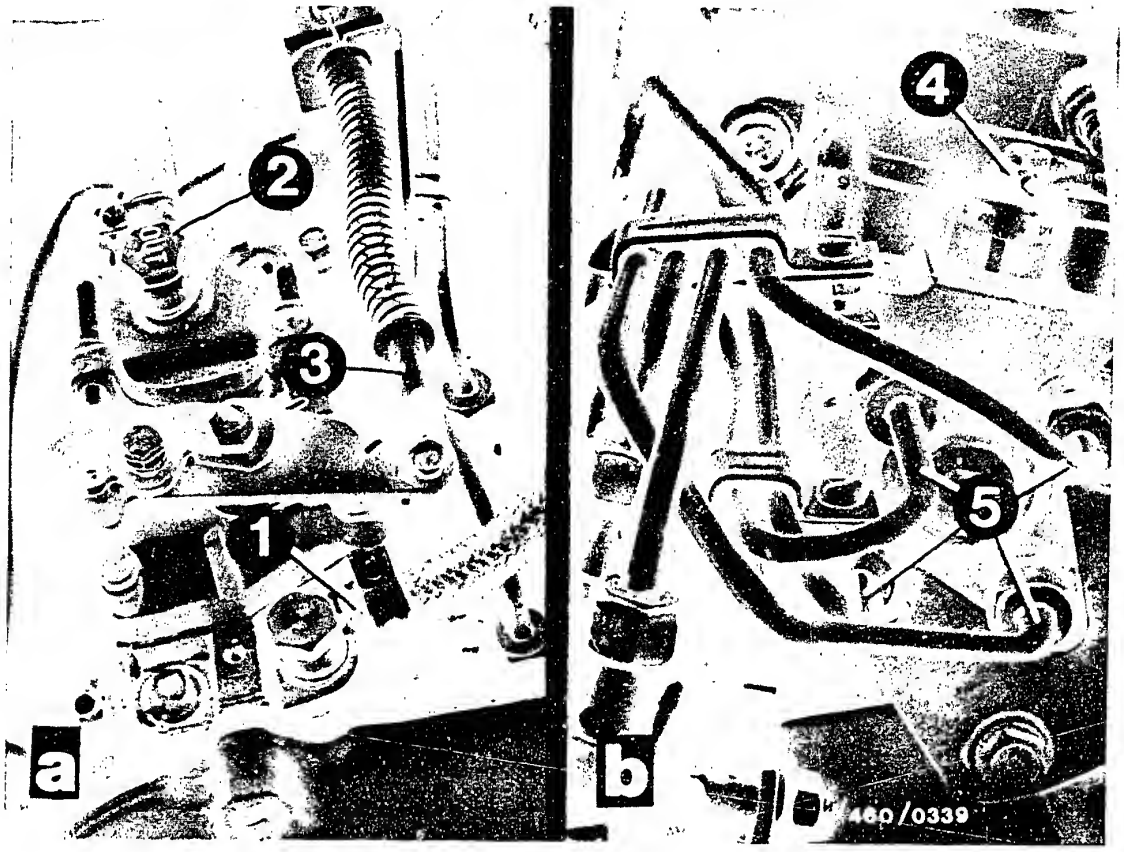
Remove bleeder screw from central screw plug (triangular plug) of hydraulic head.

Fit measuring tool KDEP 1085 with dial indicator e.g. 1 687 233 011 into this bore and preload by approx. 3mm.

Turn engine against its direction of rotation until pointer of dial indicator no longer moves.
Preload dial indicator by approx. 1 mm and set to "0".



Turn engine in its direction of rotation until the markings on the camshaft gear, injection-pump gear and the TDC mark on the flywheel are in alignment (cyl. 1 TDC).
In this position the dial indicator must indicate a stroke of 0.82 mm.
If it is necessary to make an adjustment, loosen injection-pump fastening screws. Pivot injection pump until stroke of 0.82 mm is reached. Tighten fastening screw to 29 Nm (2.8 kgfm). Turn engine over twice and check adjustment.
Remove measuring tool KDEP 1085 with dial indicator.
Fit bleeder screw with new seal ring.



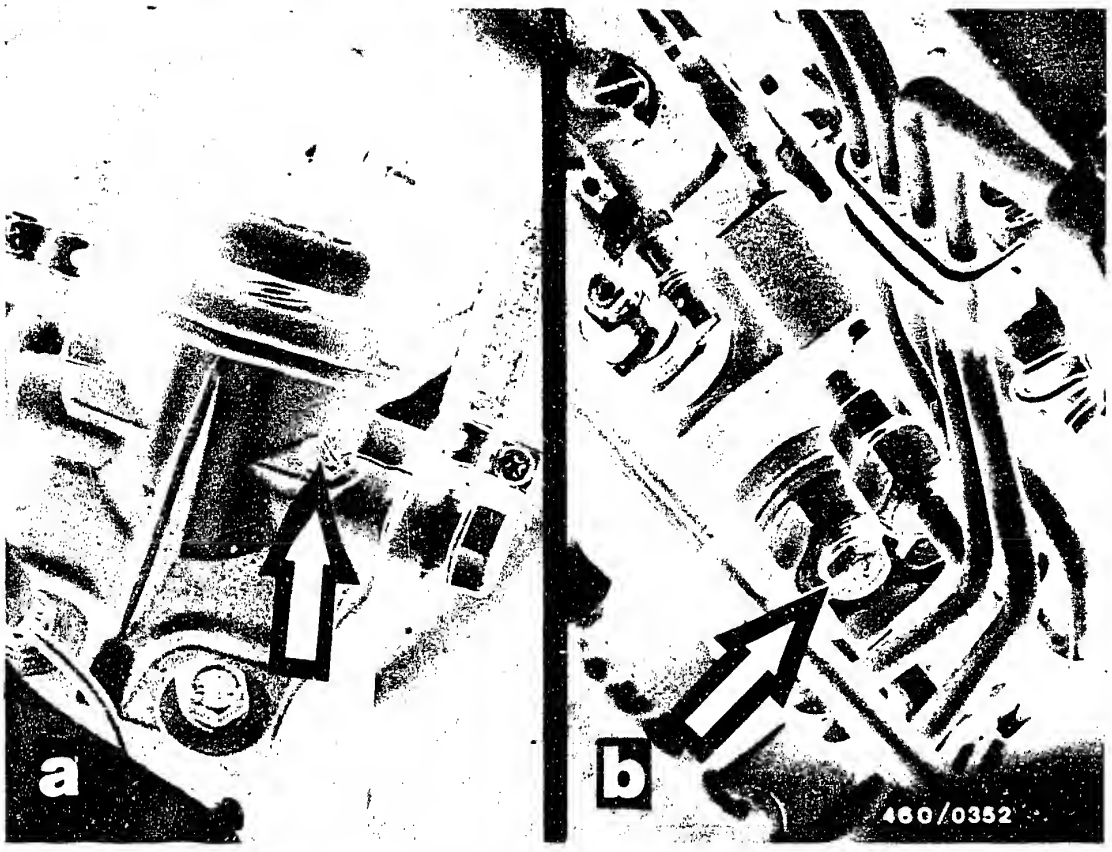
Fit fuel inlet line (1), fuel return line (2), cable on control lever (4), electric lead on shutoff solenoid and fuel-injection tubing (5) on injection pump.

Note:

The inlet-union screws of the fuel inlet and fuel return lines must not be mixed up. The inlet-union screw of the return line is provided with a restriction bore and the head of the screw is marked "OUT".

Fit engine timing cover. Connect positive terminal of battery.

Bleed fuel-injection system.



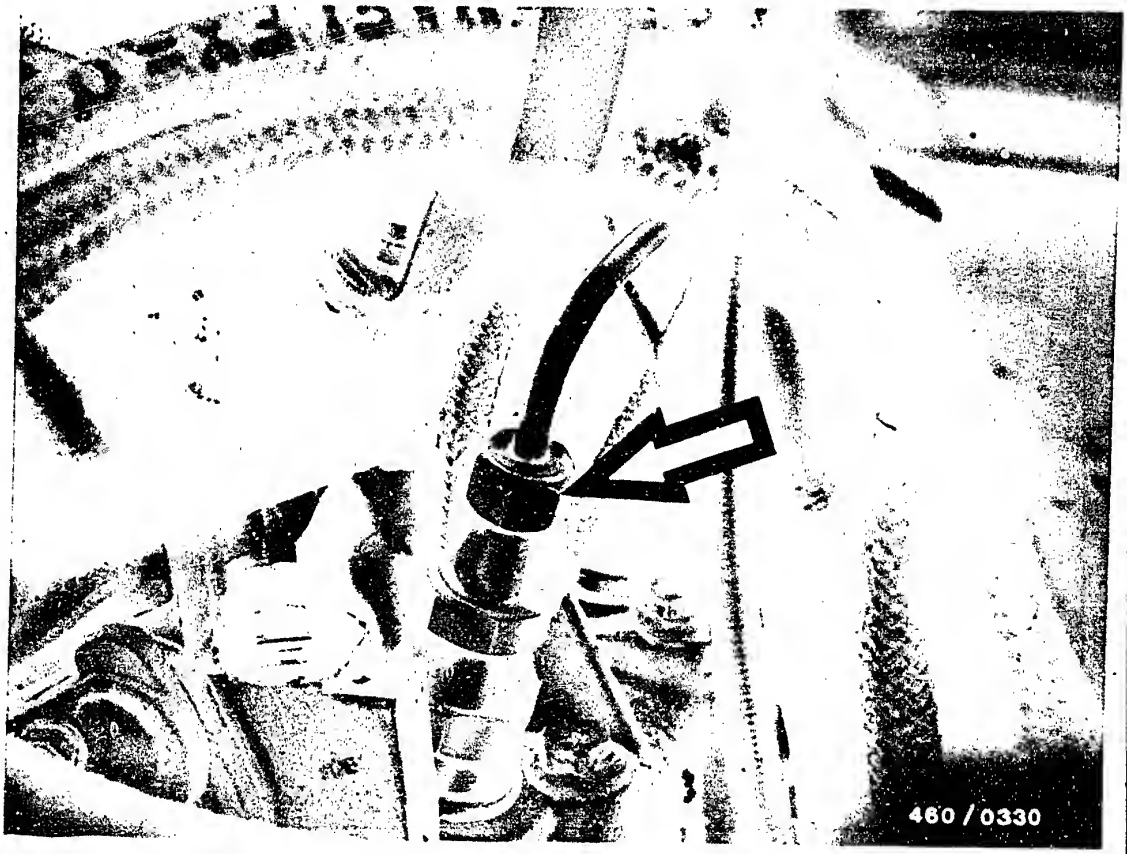
Bleed fuel-injection system

Fill up fuel filter and fuel-injection pump with diesel fuel.

Loosen bleeder screw on fuel filter (arrow - Fig. a) and on injection pump (arrow - Fig. b) by a few turns.

Operate hand primer on fuel filter until the fuel escaping from the bleeder screw of the fuel filter is free of bubbles.

Tighten fuel filter bleeder screw.

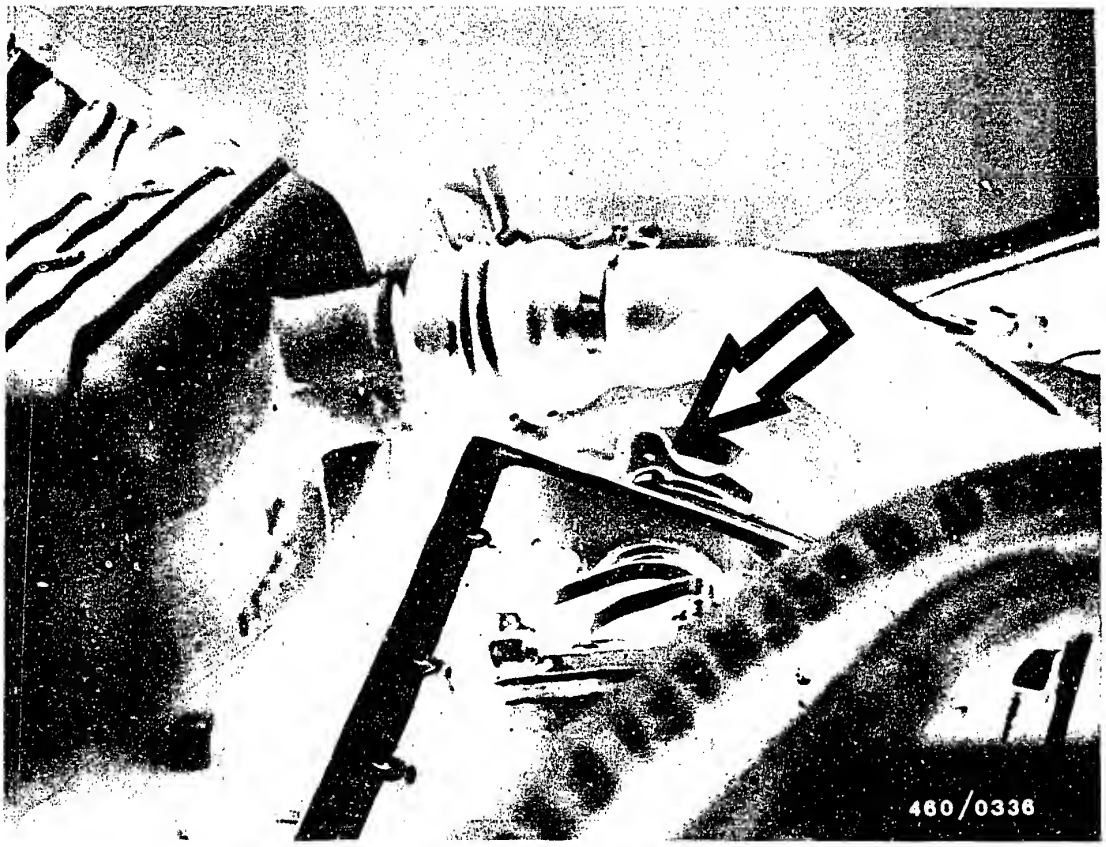


Loosen union nuts (arrow) of fuel-injection tubing on nozzle-holder assemblies.

Actuate starting motor without pre-heating. When the fuel escaping from the bleeder hole in the injection pump is free of bubbles tighten the bleeder screw.

Continue to actuate starting motor until fuel escapes at union nuts of nozzle-holder assemblies.
Tighten union nuts.

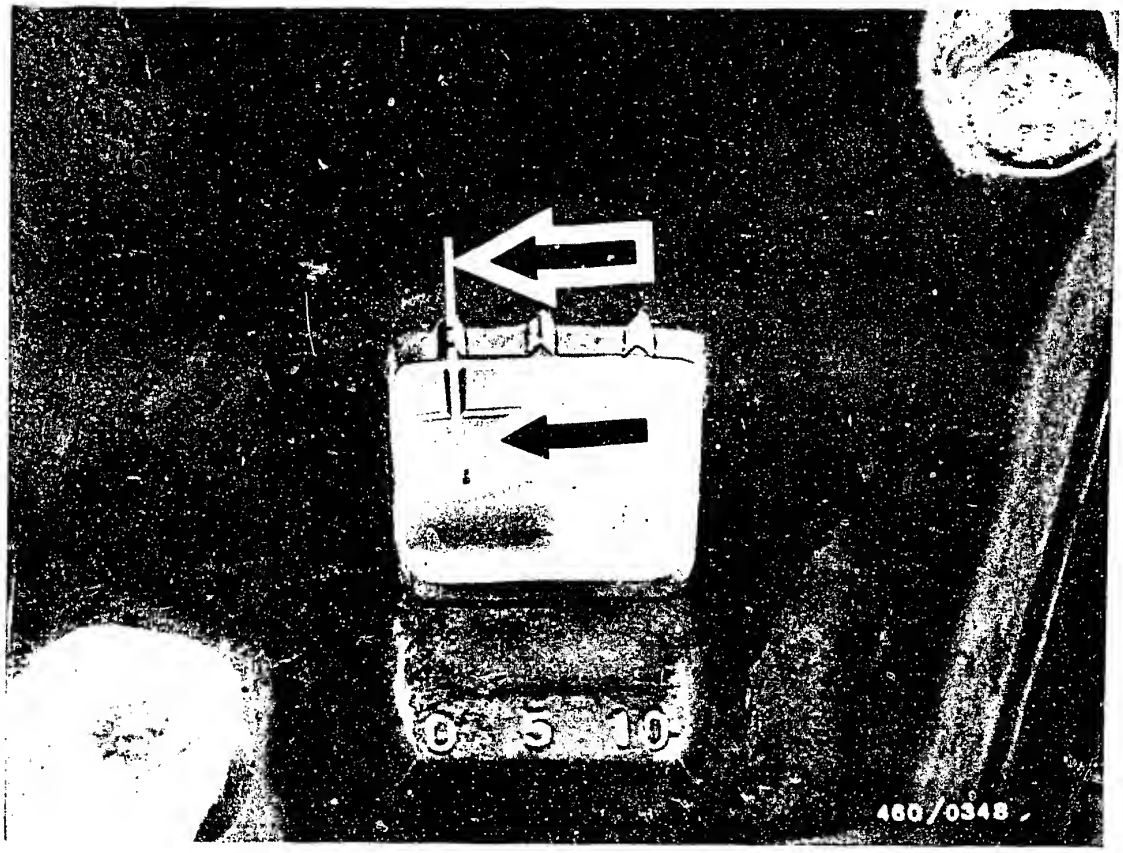
Actuate starting motor until engine starts.



23.3 Check and adjust engine timing

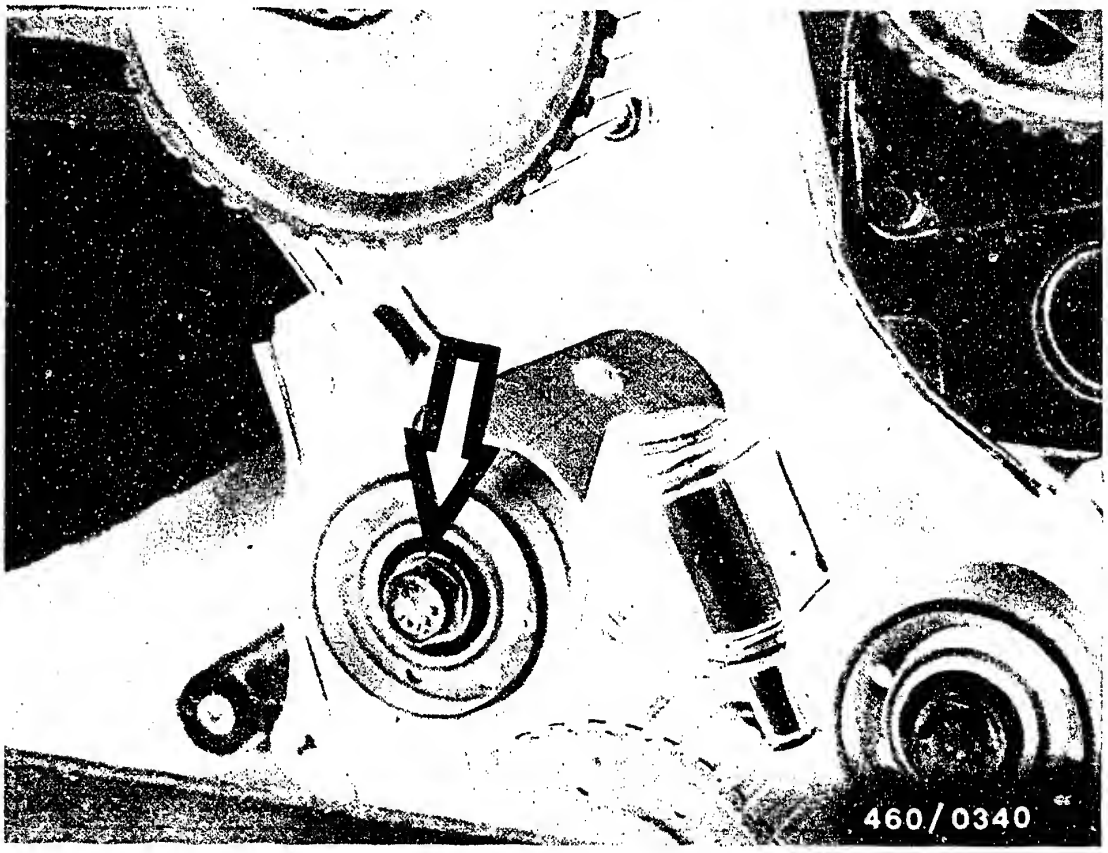
23.3.1 Check engine timing

Remove cover for engine timing and injection-pump drive. Turn crankshaft so that marking on camshaft gear is in alignment with the fixed mark on the cylinder head.



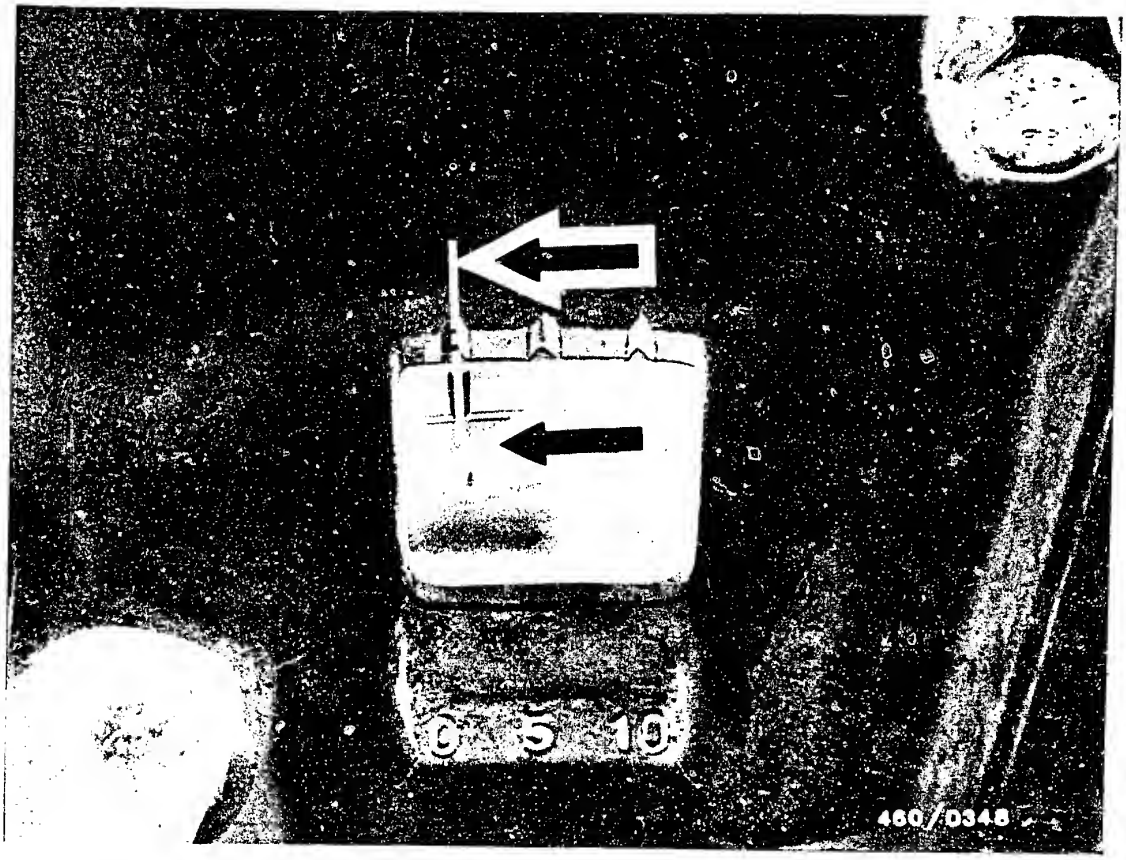
The TDC mark on the flywheel must be in alignment with the reference mark (arrows).

If the marks are not in alignment, it is necessary to adjust the engine timing.

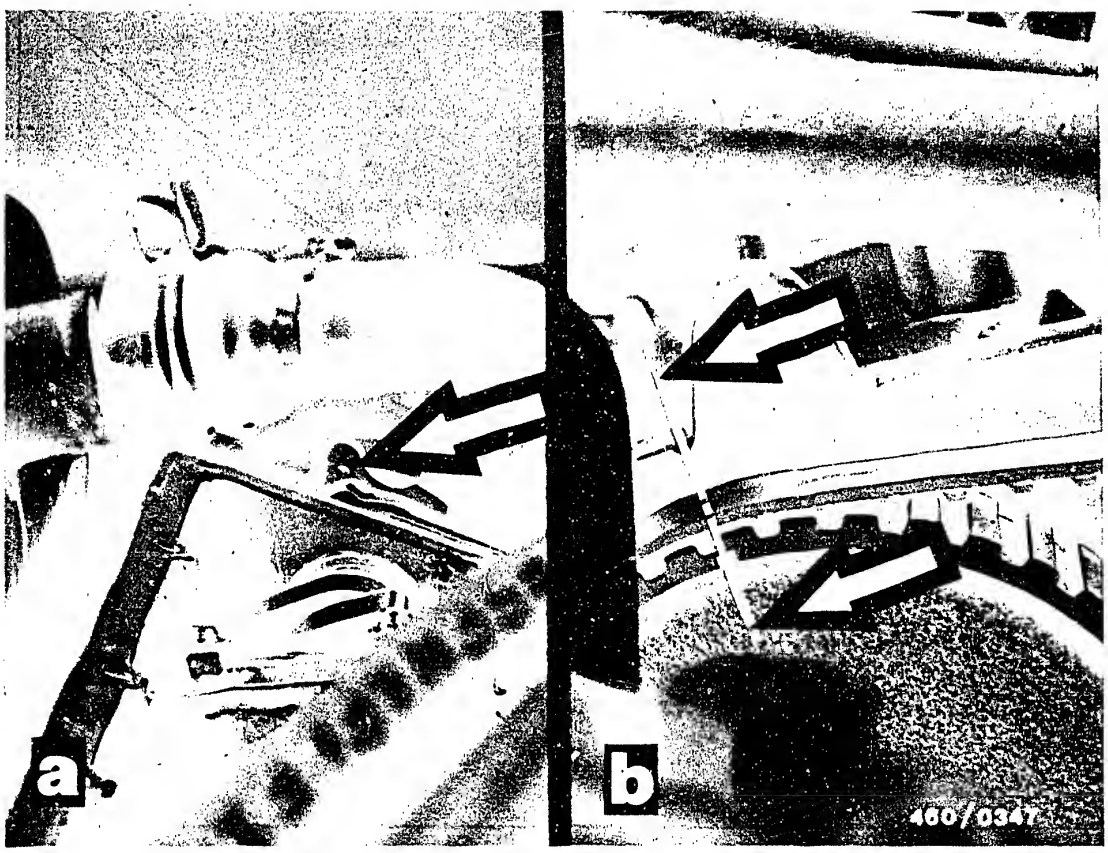


23.3.2 Adjust engine timing

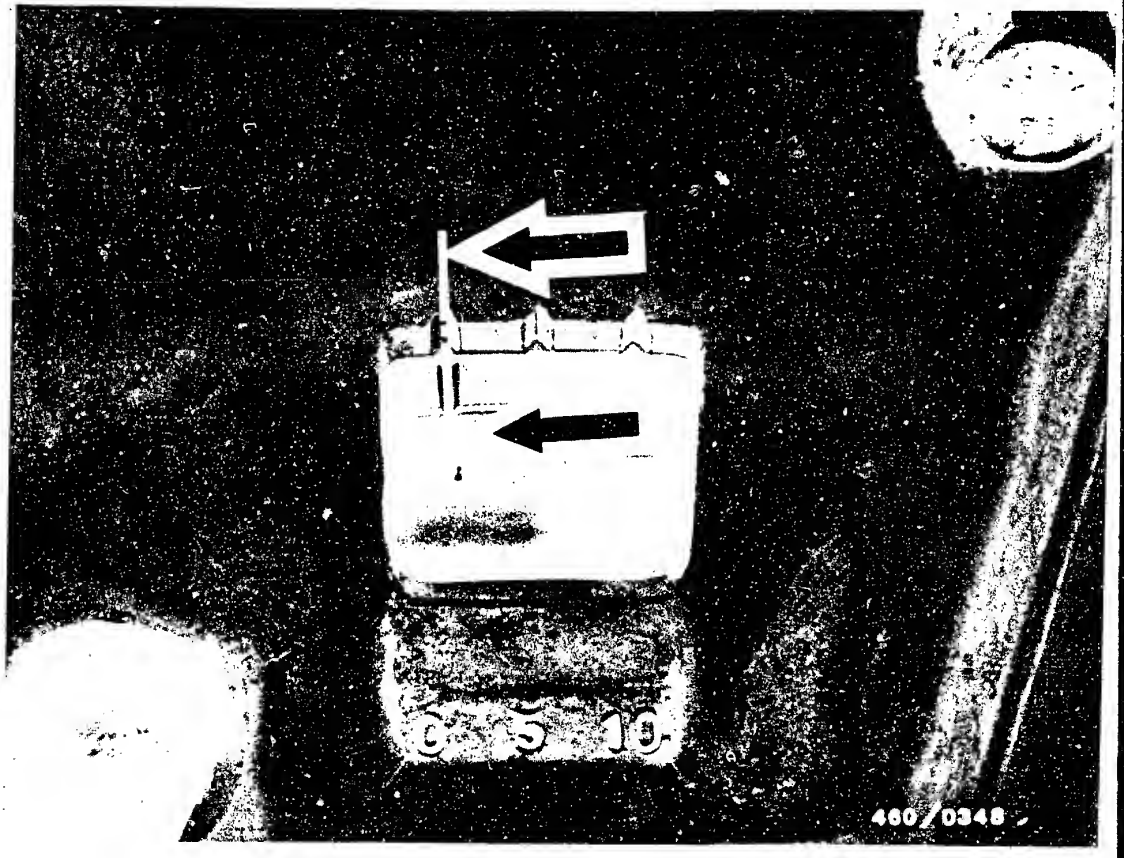
Loosen fastening screw of belt tensioner roller.
Press belt tensioner roller against spring force of belt tensioner until toothed belt is relaxed.
Remove toothed belt from camshaft gear and injection-pump gear.



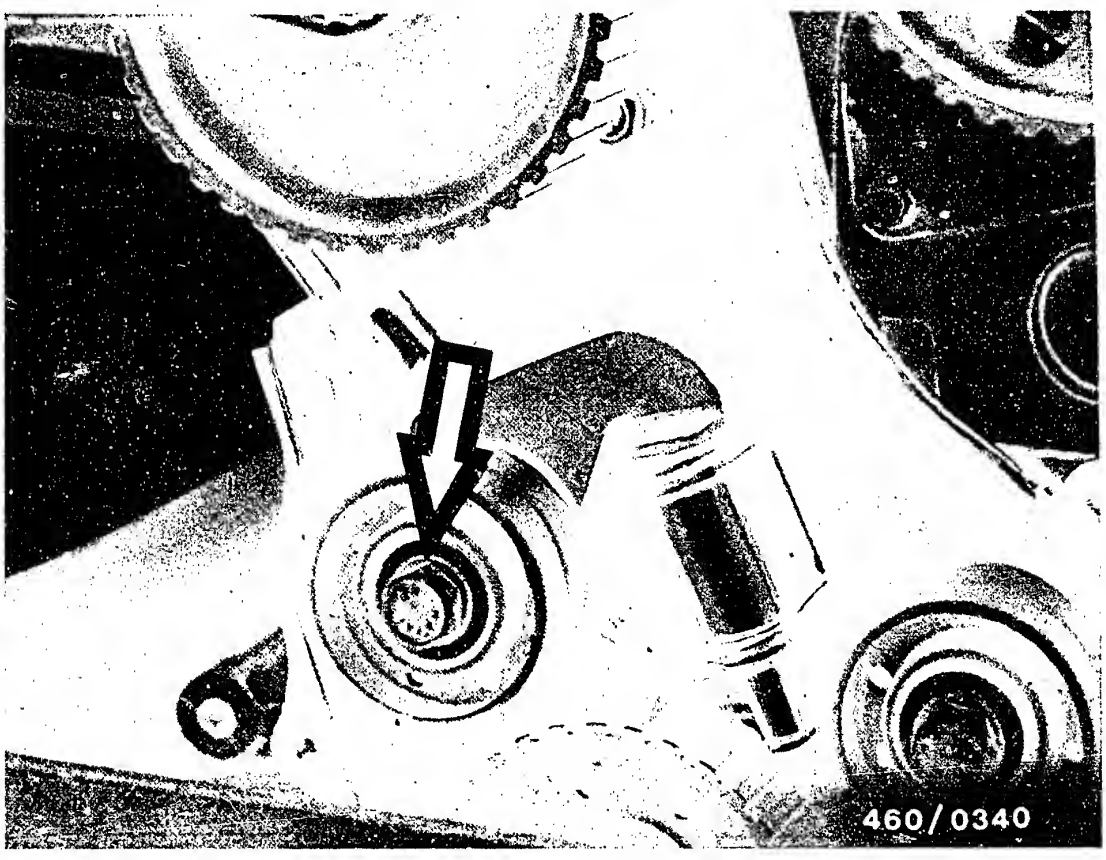
Turn crankshaft until the marking on the flywheel is in alignment with the reference mark on the cover plate.



Re-fit toothed belt.
Make sure that the markings on the camshaft gear and injection-pump gear point to the reference marks.



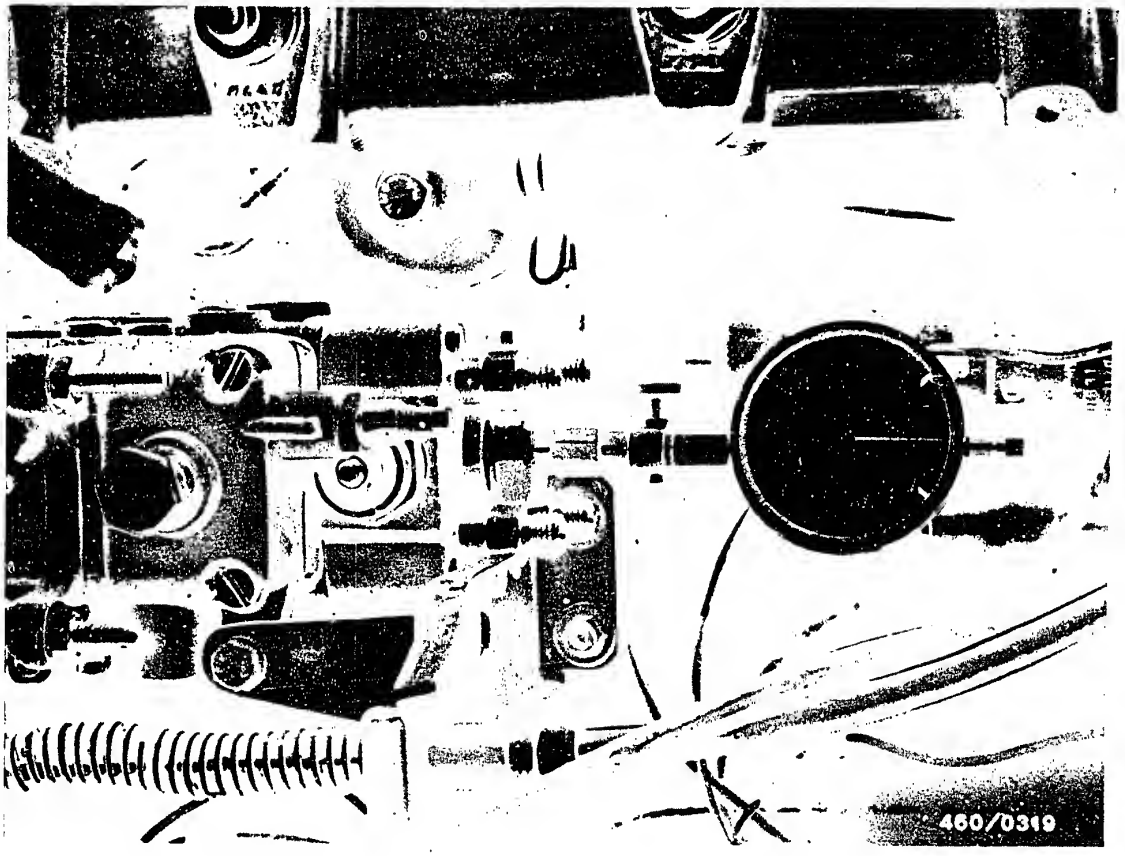
The TDC mark on the flywheel must be in alignment with the reference mark (arrows).



Loosen fastening screw of holder of belt tensioner roller until the spring-loaded belt tensioner presses against the toothed belt.

Re-tighten fastening screw. Turn engine over two full times in direction of rotation of engine until the markings on the camshaft gear, injection-pump gear and the TDC mark on the flywheel are in alignment with the reference points.

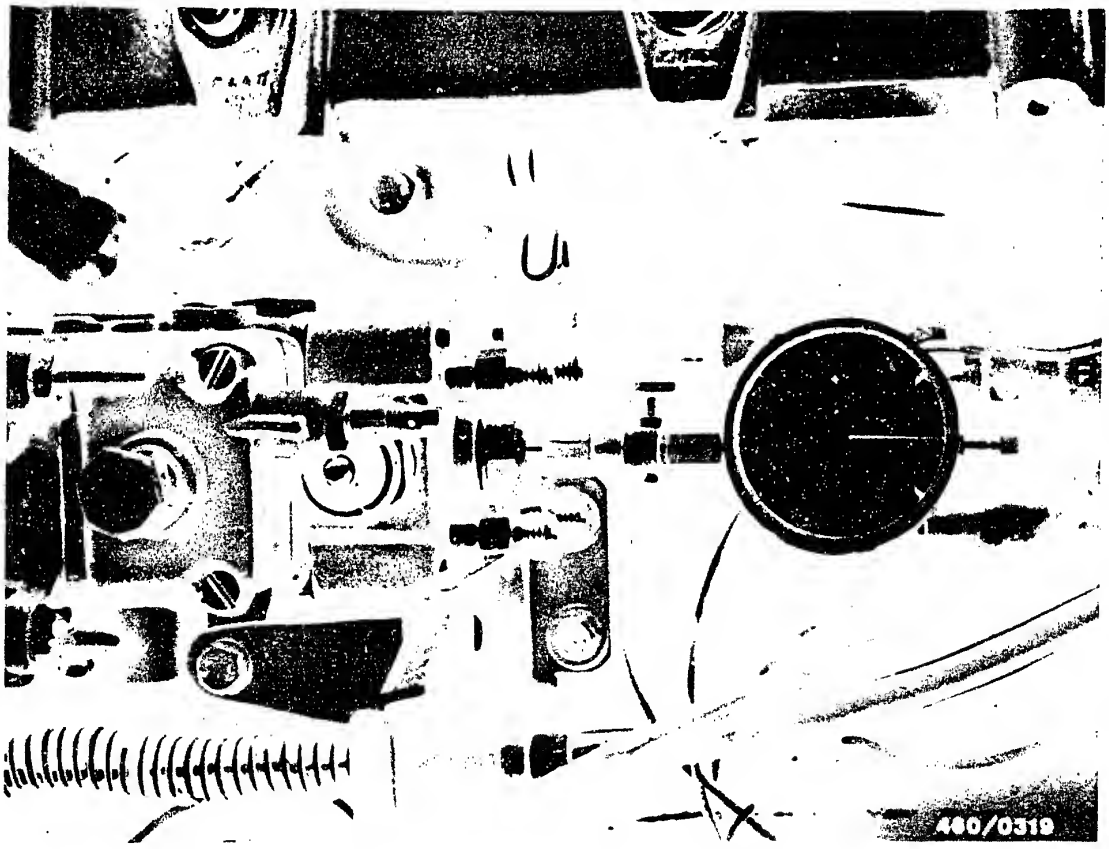
Loosen fastening screw of holder of belt tensioner roller until spring-loaded belt tensioner presses against toothed belt.
Tighten fastening screw to 56 Nm.



Remove fuel-injection tubing from injection pump and nozzle-holder assemblies. Remove bleeder screw from central screw plug (triangular plug) of hydraulic head.

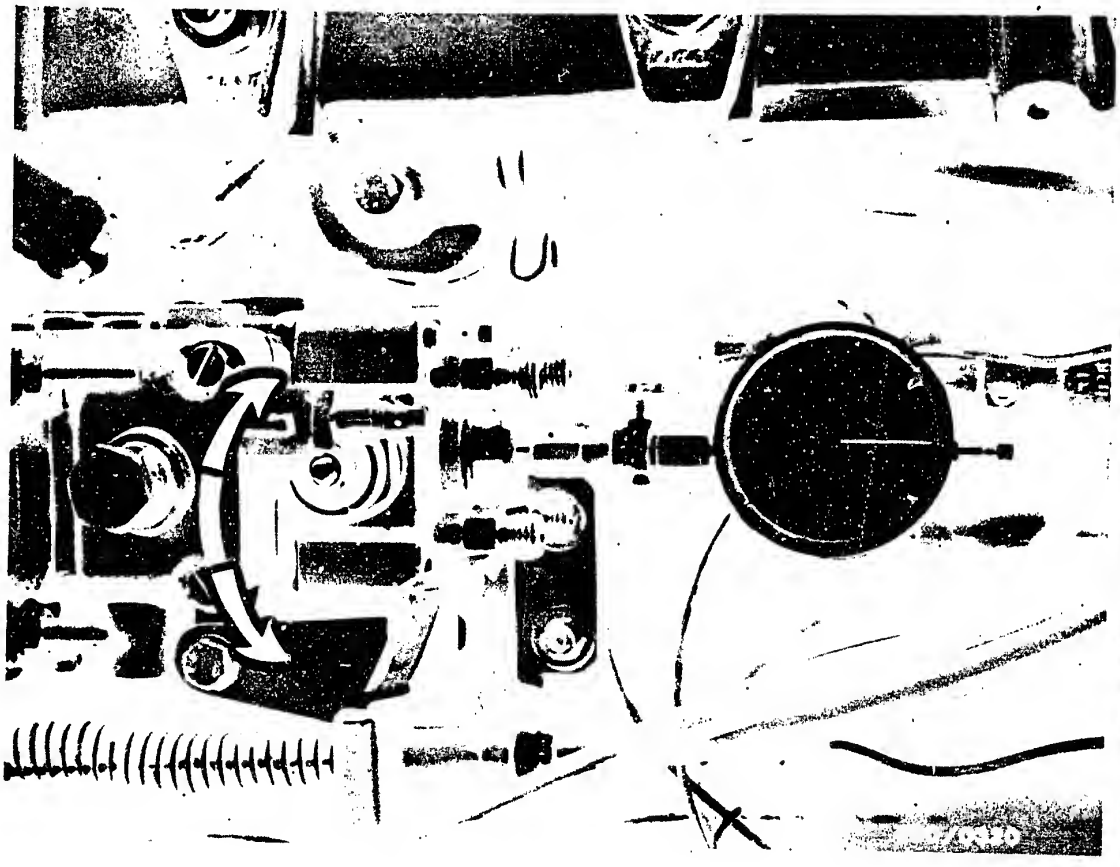
Fit measuring tool KDEP 1085 with dial indicator (e.g. 1 687 233 011) into this bore and preload by approx. 3 mm.

Turn engine against its direction of rotation until pointer of dial indicator no longer moves. Preload dial indicator by approx. 1 mm and set to "0".



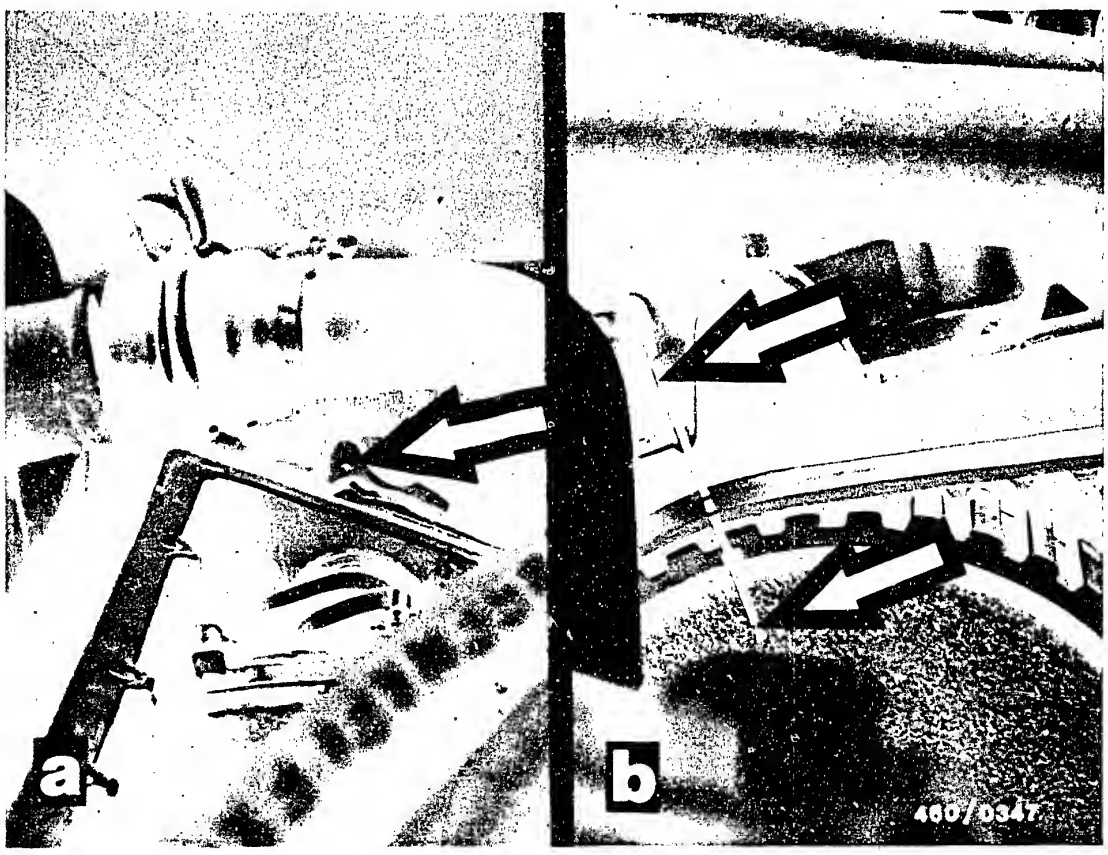
Turn engine in its direction of rotation until the markings on the camshaft gear, injection-pump gear and the TDC mark on the flywheel are in alignment (cyl. 1 TDC).

In this position the dial indicator must indicate a stroke of 0.82 mm.



If an adjustment is necessary, loosen fastening screws of fuel-injection pump.
Pivot injection pump until a stroke of 0.82 Nm is reached. Tighten fastening screws to 29 Nm (2.9 kgfm).
Turn engine over twice and check adjustment.
Remove measuring tool KDEP 1085 with dial indicator.

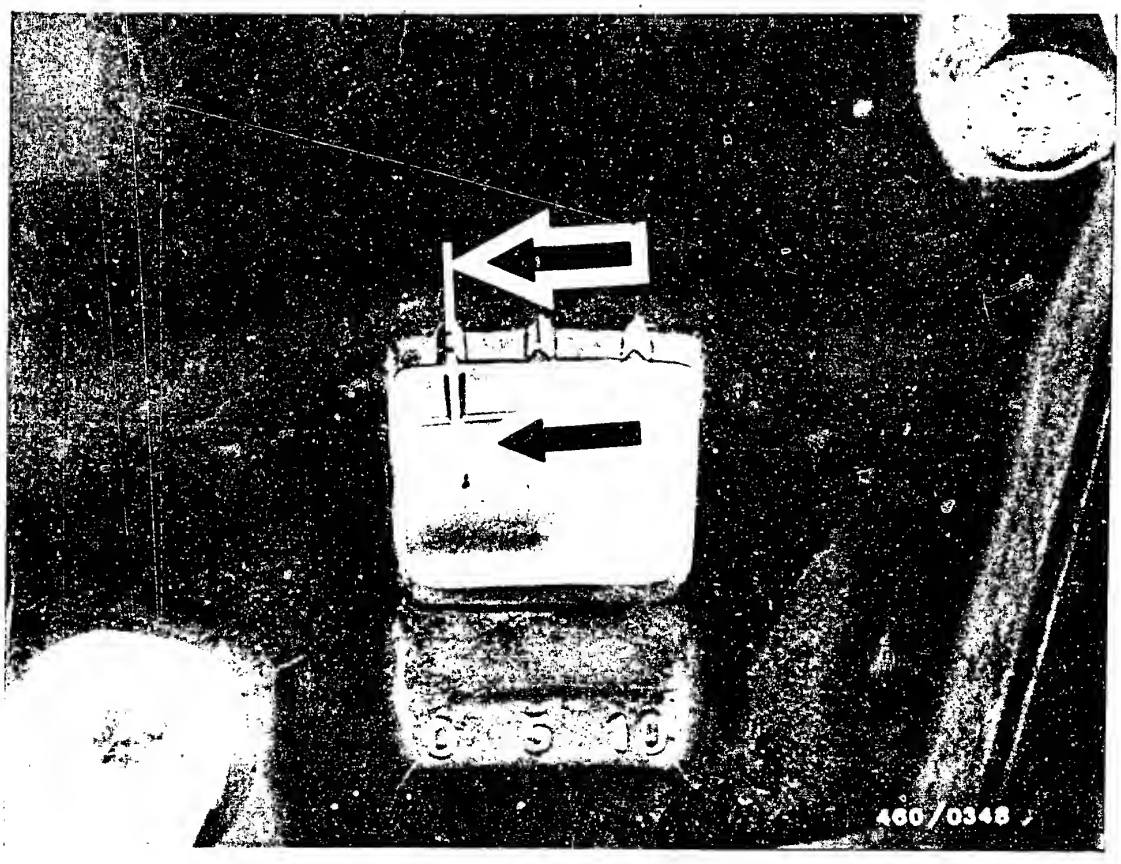
Fit bleeder screw with new seal ring. Screw fuel-injection tubing onto delivery-valve holders of injection pump and nozzle-holder assemblies.
Screw down injection-pump support bracket on engine.
Fit engine timing cover plate.



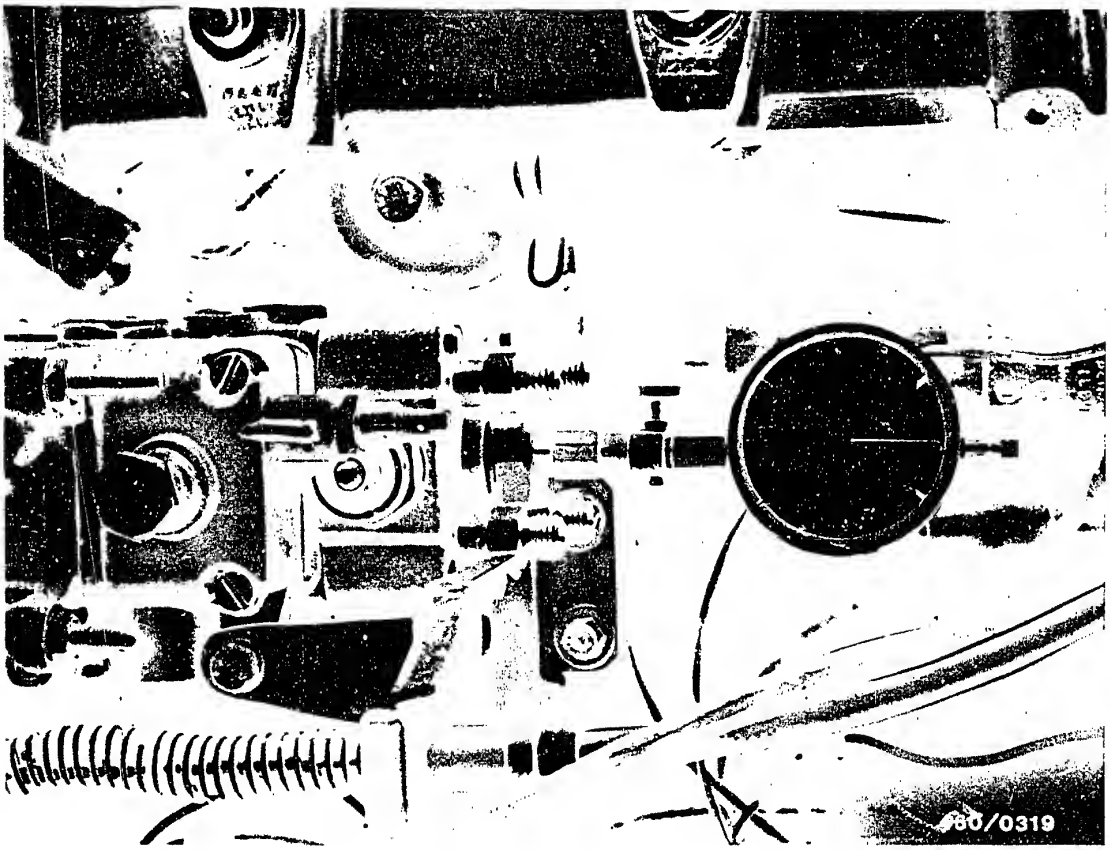
23.4 Injection timing

Remove engine timing cover plate.

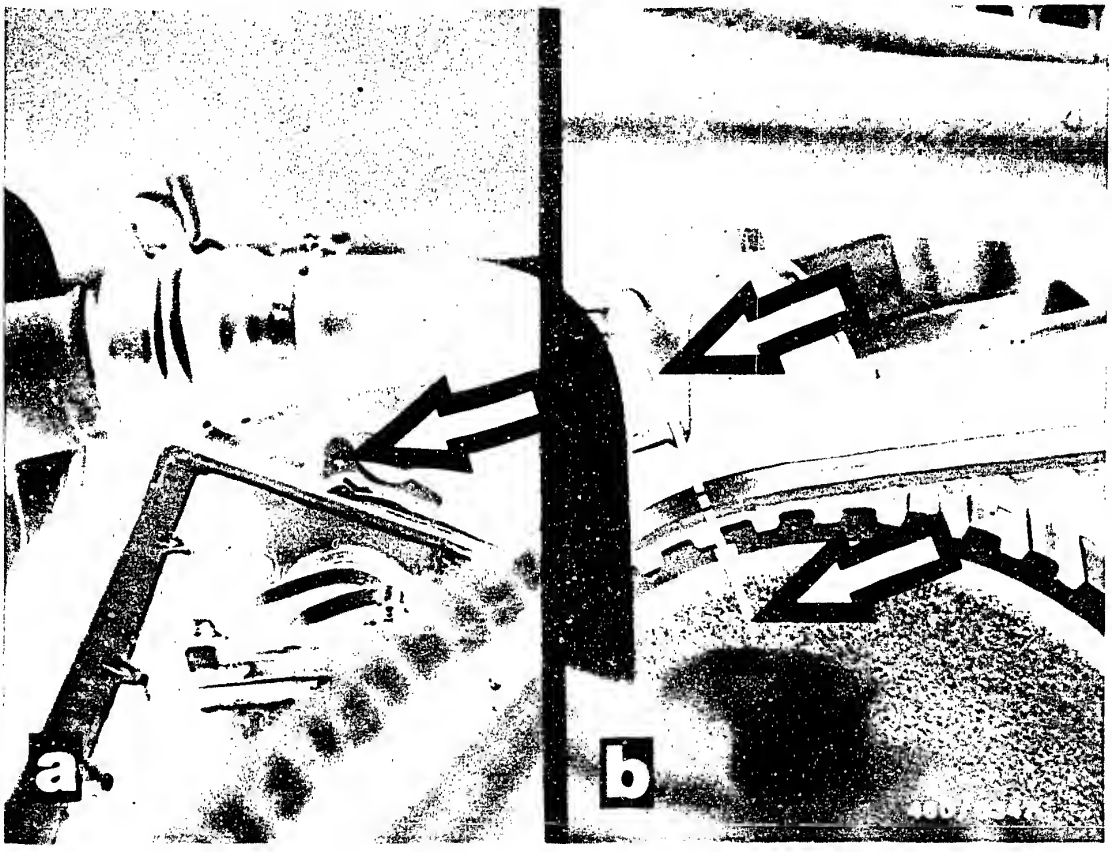
Remove fuel-injection tubing from injection pump and nozzle-holder assemblies.
Turn engine in its direction of rotation until the markings on the camshaft gear (Fig. a) and injection-pump gear (Fig. b) are in alignment with the reference marks.



The TDC mark on the flywheel must be in alignment with the reference mark.

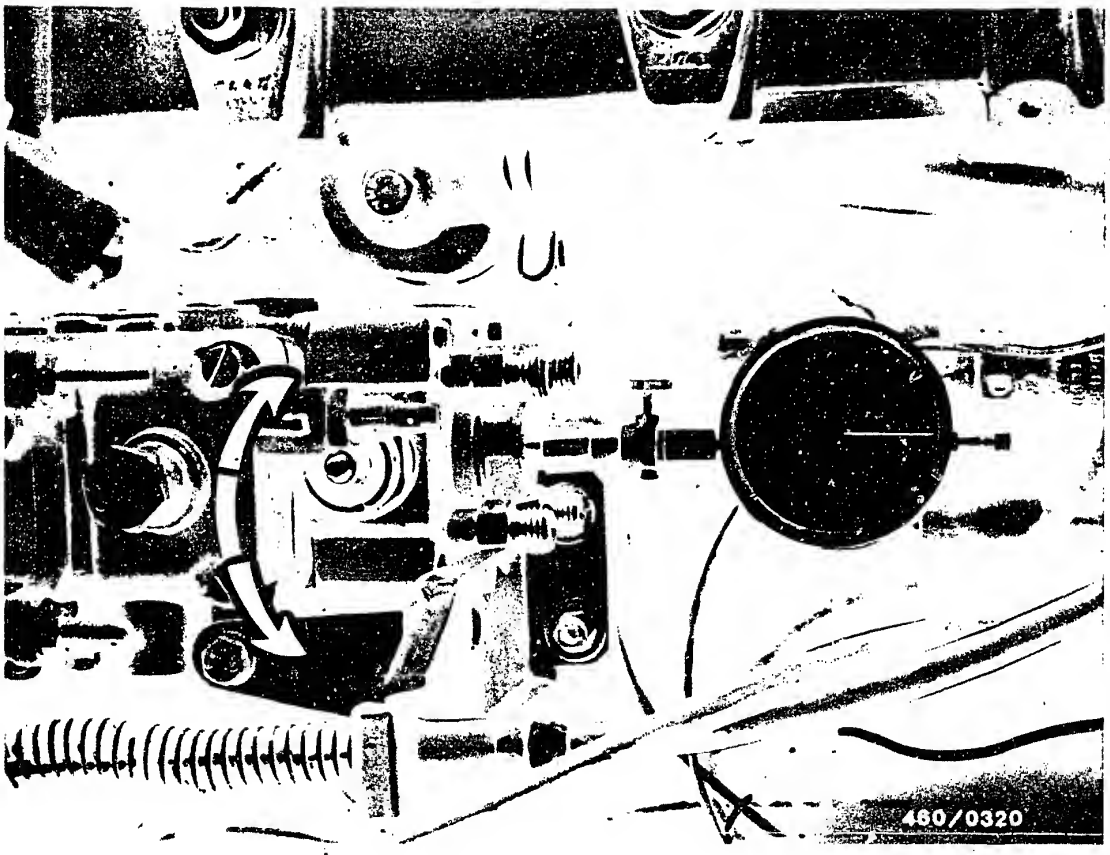


Remove bleeder screw from central screw plug (triangular plug) of hydraulic head.
Fit measuring tool KDEP 1085 into this bore. Insert dial indicator (e.g. 1 687 233 011) and preload by approx. 3 mm.
Turn engine crankshaft against its direction of rotation until the pointer of the dial indicator no longer moves.
Preload dial indicator by approx. 1 mm and set to "0".



Turn engine crankshaft in its direction of rotation until the markings on the camshaft gear and injection-pump gear are in alignment with the reference marks.

In this position the dial indicator must indicate a stroke of 0.82 mm.



If it is necessary to make an adjustment, loosen the injection pump fastening screws.
Pivot the injection pump until a stroke of 0.82 mm is reached.
Tighten the fastening screws to 29 Nm (2.9 kgfm).
Turn the engine over twice and check the adjustment.

Remove measuring tool KDEP 1085 with dial indicator.
Fit bleeder screw with new seal ring.

Screw fuel-injection tubing onto delivery-valve holders of injection pump and onto nozzle-holder assemblies.

Fit engine timing cover plate.

After-sales Service

Motor Vehicle Service Information

FIAT 127
with VE...F distributor-type
fuel-injection pump

VDT-I-FIA 021 En
7.1981
supersedes Ed. 5.1981

The FIAT 127 with water-cooled 4-cylinder diesel engine with swirl chamber x 8/29 is fitted with the VE..F distributor-type fuel-injection pump with part-load governor, load-dependent start of pump delivery (LAFB), cold-start accelerator and electromagnetic shutoff device.

Engine data

Swept vol.	Power	Rated speed	Firing order	Compression
1306 cm^3	33 kW (45 HP-din)	5000 min^{-1}	1-3-4-2	21.5 : 1

Fuel-injection equipment

Distributor-type fuel-injection pump	0 460 484 006	- VE 4/8 F 2500 R 61
Single-stage box-type filter	0 450 126 009	- FJ/DBH 1 W 5/135
Fuel filter box	1 457 434 106	
Nozzle-and-holder assembly comprising:	9 430 082 271	
Nozzle holder	9 430 080 200	- BR-KCA 30 S 41
Nozzle	9 430 087 204	- DN 12 SD 1750
Nozzle-opening pressure:	130 bar	

Technical documentation

The necessary technical documentation has been issued.

For service-part lists see microfiche.

If required, send for test specifications to KH/VSK 1 (Tel. 07153-63-623) until they appear on microfiche.

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Injection pump timing

The timing of the distributor-type pump is performed using the dial indicator method.

Setting point:	Pump:	0.82 mm ABDC
	Engine:	TDC mark cyl. 1 on flywheel

Work units

Work units for repairing and testing the VE distributor-type fuel-injection pump have not yet been issued.

Provisional work units:

Complete dismantling, testing	max. 35 work units
Checking, adjusting and eliminating a minor defect (e.g. leak)	max. 16 work units

Warranty procedure

See VDT-I-FIA 012

After-sales service information

For this VE..F distributor-type fuel-injection pump after-after sales service is performed in the usual manner.

Please contact your local FIAT agent and enquire about the sales figures for these vehicles.

Make sure that your workshop offers an efficient and fast service for the injection system fitted in this vehicle.

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